

Research Announcement

Research Opportunities in Space Life Sciences

**A Research Announcement for the
Life Sciences Division**

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| Letters of Intent: | April 15, 1996 |
| Proposals Due: | May 15, 1996 |

**NASA Research Announcement
Soliciting Proposals
for
Research Opportunities
in
Space Life Sciences**

NRA 96-OLMSA-01A
Issued: February 20, 1996
Letters of Intent: April 15, 1996
Proposals Due: May 15, 1996

Life Sciences Division

**Office of Life and Microgravity Sciences and Applications
National Aeronautics and Space Administration
Washington, DC 20546-0001**

**NASA Research Announcement
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in
Space Life Sciences**

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NASA Research Announcement

Research Opportunities in Space Life Sciences

This National Aeronautics and Space Administration (NASA) Research Announcement (NRA) solicits proposals to participate in research opportunities in space life sciences. This is a broad-based announcement that solicits research proposals that support the opening of the space frontier by exploring, using and enabling the development of space and by expanding human experience in space. In consonance with NASA's strategic plan, research supported by the Life Sciences Division will increase human knowledge of nature's processes using the space environment, aid in the exploration and settlement of the Solar System, support the achievement of routine space travel, and enrich life on Earth through people living and working in Space. The major means that the Life Sciences Division will employ in supporting these goals are: scientific research, engineering technology, the Space Shuttle, and the International Space Station. The specific programs that are included in this announcement are Space Biology, Space Physiology and Countermeasures, Environmental Health, Space Radiation Health, Behavior and Performance, Advanced Technology Development, and Data Analysis. Proposals submitted in response to this Announcement may be for ground-based research investigations or for limited types of space-flight experiments designed for the Shuttle middeck or for the earliest phase of utilization of the International Space Station. Proposals may be for activities lasting up to four years and beginning in FY 1997; proposals to conduct ground-based research aimed at developing mature experiments designed for the later phases of space station utilization are particularly encouraged.

Subsequent Announcements similar to and based upon this Announcement will be updated and issued annually and will be the primary means of obtaining research proposals from the scientific community for most research in the space life sciences. Although this Announcement is broad-based, it is restricted to the science programs named above and described in detail in Appendix A. The potential proposer should read the program descriptions that are of interest with care and attempt to focus the proposal on the specific research emphases defined in this Announcement.

Participation in this Announcement is open to all individuals and all categories of domestic and foreign organizations, industry, educational institutions, other nonprofit organizations, NASA laboratories, and other government agencies. Proposals which will enhance or complement the scientific return from research currently being supported by the National Institutes of Health, the National

Science Foundation, or other government agencies are encouraged. In addition, proposals to advance technology and develop practical applications of technology are sought under this Announcement. Because of the limitations of access to flight opportunities, it is expected that the majority of proposals approved in response to this Announcement will be for ground-based research. A letter of intent to propose is requested by April 15, 1996. Proposals may be submitted at any time up to May 15, 1996. Proposals will be evaluated for overall scientific/technical value, relevance, implementation feasibility, and cost. A selection announcement will be made between October and November of 1996. Funding of selected proposals will begin sometime between October 1996 and September 1997.

Further details relevant to these programs are included in the enclosed appendices. Appendix A provides technical information applicable only to this Announcement in the general areas in which proposals are solicited and includes supplemental information to Appendix B. Appendix B contains the basic guidance needed for the preparation of solicited proposals in response to this Announcement. Appendix C describes special facilities available for use by proposers. Appendix D describes the experiment accommodations provided in the middeck of the Shuttle and on the International Space Station during the earliest utilization phase and the space flight equipment that will be available to support these opportunities. Appendix E contains forms for inclusion with proposals submitted in response to this NRA.

The following items apply only to this Announcement.

| | |
|---------------------------------------|--|
| Solicitation Announcement Identifier: | NRA 96-OLMSA-01A |
| Number of Copies Requested: | Original + 20 copies |
| Letters of Intent Due: | April 15, 1996 |
| Proposals Due: | May 15, 1996 |
| Selecting Official: | Director Life Sciences Division Office of Life and Microgravity Sciences and Applications |

Obtain Additional Information From: the appropriate Science Program Manager, as indicated in the table below, at the following address:
 UL/Life Sciences Division
 NASA Headquarters
 Washington, DC 20546-0001
 Telephone: (202) 358-2530
 Fax: (202) 358-4168

| Program | Program Manager |
|--------------------------------------|---|
| Space Biology | Tom K. Scott, Ph.D. |
| Space Physiology and Countermeasures | Victor S. Schneider, M.D. or Mary Anne Frey, Ph.D. |
| Environmental Health | Victor S. Schneider, M.D. |
| Space Radiation Health | Walter Schimmerling, Ph.D. |
| Behavior and Performance | Victor S. Schneider, M.D. |
| Advanced Technology Development | Gregory K. Schmidt |
| Data Analysis | Ronald J. White, Ph.D. |
| Flight Experiments | Peter R. Ahlf |

Proposals and Letters of Intent mailed through the U.S. Postal Service by express, first class, registered, or certified mail are to be sent to the following address:

Information Dynamics, Inc.
 SUBJECT: NASA Life Sciences Research Proposal
 300 D Street S.W.
 Suite 801
 Washington, DC 20024.

Special instructions apply to foreign (non-U.S.) proposals. In addition to sending the original (signed) proposal and twenty (20) copies to NASA through Information Dynamics, Inc., as directed above, **one (1) additional copy along with the Letter of Endorsement must** be forwarded to:

Ms. Ruth Rosario
 IH/Space Flight Division
 Ref: NRA 96-OLMSA-01A
 NASA Headquarters
 Washington, DC 20546-0001
 USA

Proposals and Letters of Intent hand delivered or sent by commercial delivery or courier services are to be delivered to the above addresses between the hours of 8:00 AM and 4:30 PM.

The telephone number (202) 479-2609 may be used when required for reference by delivery services. Information Dynamics, Inc. (IDI) cannot receive deliveries on Saturdays, Sundays, or federal holidays.

Letters of intent (only) may also be submitted electronically via e-mail or World Wide Web to the following addresses:

E-mail: loi@gm.olmsa.hq.nasa.gov

World Wide Web: <http://peer1.idi.usra.edu>

Following receipt of a proposal by IDI, a postcard will be sent to the proposer confirming receipt of the proposal and notifying the proposer of any missing data (reference proposer checklist, Form I, Appendix E) that are required for the subsequent reviews.

The government's obligation to make awards is contingent upon the availability of appropriated funds from which payment for award purposes can be made and the receipt of proposals that the government determines are acceptable for award under this NRA. It is anticipated that approximately 40 awards averaging \$125,000 (total costs) each annually will be made, although the total annual cost may vary from \$15,000 to \$350,000. Your interest and cooperation in participating in this effort are appreciated.

Original Signed by

Harry C. Holloway, M.D.
Associate Administrator for
Life and Microgravity Sciences and Applications

**RESEARCH OPPORTUNITIES
IN
SPACE LIFE SCIENCES**

I. INTRODUCTION

The Life Sciences Division of the National Aeronautics and Space Administration (NASA) seeks proposals for research that support the various scientific programs of the Division. This Announcement will be one of two primary solicitations used to obtain scientific or technical proposals to be funded during Fiscal Year 1997, either for new research or for the continuation of research beyond the term specified in a previously funded proposal. A companion Announcement (*Advanced Life Support and Environmental Technologies for Human Exploration and Development of Space*, NRA 96-OLMSA-01B) soliciting proposals focused on certain technologies is also available from the Division and should be consulted for further opportunities. Other Announcements calling for focused research or utilization of unique resources may be issued throughout the year. It should be noted, however, that unsolicited proposals for scientific or technical research that are submitted to the Division for evaluation will be held until the next annual review period if the proposed research is relevant to the programs described in this Announcement. Unsolicited proposals outside of the research emphases defined in this Announcement will, in most cases, be returned to the proposer. However, NASA reserves the right to act in the best interests of the federal government in the matter of proposal acceptance and evaluation.

This Appendix describes the types of proposals that are acceptable for submission in response to this Announcement, defines the research programs of the Division that are included in this Announcement, and describes the current areas of ground-based and flight research emphases that proposals should address. In addition, this Appendix includes guidelines for preparing and submitting proposals and defines the administrative policies governing the program and grantees.

II. PROPOSAL TYPES

To be acceptable, each proposal submitted under this Announcement must be one of two types:

1. Ground-Based Research Investigation

It is expected that the majority of proposals submitted in response to this solicitation will fall into the category of standard research proposals, i.e., proposals to carry out a scientific or technical study in an Earth laboratory and having a clearly defined set of research objectives. All proposals must be consistent with the research areas and emphases defined in this Announcement if they are to be considered for funding. Proposals to conduct ground-based research aimed at developing mature experiments designed for the later phases of International Space Station utilization (from 2001 onwards) are particularly encouraged. Some proposals may require special NASA Earth-based facilities for their completion (see Appendix C for a description of special NASA facilities). If such a proposal is selected, NASA will seek to provide access to the required facilities for the investigator. Finally, as part of their research plan, proposers may request tissues from organisms that have flown in space. These tissues, not required by previous primary space-flight investigations, will be provided at no additional cost through the Division's Biospecimen Sharing Program (see Section IV of this Appendix).

2. Space-Flight Experiment

Proposals are sought to carry out either of two special types of scientific studies in space: (1) experiments, called Small Payloads Experiments, that can be implemented (primarily on the Shuttle middeck) without the use of major mission resources; and (2) experiments that can be implemented with the limited resources available on the International Space Station during the early assembly (construction) phase (1998-1999). Proposals to carry out space studies of either of these two types are severely constrained in both the resources (weight, power, crew time, etc.) and the flight hardware available (see Appendix D) for use. Proposals requiring resources beyond the capabilities defined in this Announcement should not be submitted at this time. Although it is recognized that flight proposals may, and often must, include ground-based research, flight investigations must represent mature studies that are strongly anchored in previous ground research and/or previous flight research.

Regardless of proposal type, every proposal should focus on at least one of the scientific research programs defined in the next section, and should be relevant to the goals of the Human Exploration and Development of Space Strategic Plan cited in Section VII (Bibliography) of this Appendix. A proposal may be multidisciplinary or interdisciplinary, involving combinations of these research programs, but if this is the case, that fact should be stated clearly at the beginning of the proposal. Proposals should include a well-defined research plan which can be accomplished within four years or less. NASA has a strong commitment to the ethical treatment of human and animal research subjects. Assurance of compliance with applicable federal regulations regarding human subjects and/or animal care and use is required as part of the proposal submission process (see the “Special Matters” instructions in Appendix E). Potential applicants should note that review of a proposal will not be undertaken if the required information is not supplied. Applicants who meet the qualifications and wish to be considered for the “NASA Presidential Early Career Awards for Scientists and Engineers” should indicate this in their proposal (see the “Special Matters” instructions in Appendix E).

III. RESEARCH PROGRAMS AND EMPHASES

The major goals of NASA's Life Sciences Division, located within the Office of Life and Microgravity Sciences and Applications, are to:

- Effectively use microgravity and the other characteristics of the space environment to enhance our understanding of fundamental biological processes;
- Develop the scientific and technological foundations for a safe, productive human presence in space for extended periods and in preparation for exploration; and
- Apply this knowledge and technology to improve our nation's competitiveness, education, and the quality of life on Earth

To accomplish these goals, the Division supports activities in three distinct but related areas: basic life sciences (including molecular and cellular biology as well as plant and animal physiology), space health research (including applied human physiology and behavior, radiation health, microbiology, and toxicology), and advanced life support (including intravehicular and extravehicular activity systems, human factors engineering, and radiation shielding). Thus, the programs of the Life Sciences Division extend from basic research in the

biological, environmental, and psychosocial sciences to applied research related to the development of countermeasures that mitigate the detrimental effects of space flight on humans, protect humans from the harsh environment of space, and enable safe, efficient and productive use of the space laboratories. In addition, the Division supports the development and utilization of the facilities and special technologies required in the pursuit of its research goals. This Announcement is concerned with the following program areas: Space Biology, Space Physiology and Countermeasures, Environmental Health, Space Radiation Health, Behavior and Performance, Advanced Technology Development, and Data Analysis. The companion Announcement “Advanced Life Support and Environmental Technologies for Human Exploration and Development of Space” (NRA 96-OLMSA-01B) should be consulted for additional opportunities. **Note that every area of research and every type of research can have both ground research and flight research components.**

In the remainder of this section, the research programs encompassed by this Announcement are defined, their research foci delineated, and their specific emphases for the 1997 fiscal year (October 1996 - September 1997) are specified. **It is important that the prospective investigator read the relevant section(s) carefully, as many of the programmatic emphases are different from those appearing in previous Division Announcements.**

A. SPACE BIOLOGY

Program Description

The Space Biology Program focuses on research designed to improve our understanding of the role of gravity in biological processes. This is accomplished by using a variety of gravitational environments (hypergravity, simulated hypogravity, and microgravity) as research tools or by determining the effects of the interaction of gravity and other environmental factors on biological systems. The emphasis in this Program is on advancing fundamental knowledge in the biological sciences, but the research supported often also contributes to NASA's goals of enabling human exploration of space and improving the quality of life on Earth.

The Program emphasizes research in developmental biology, cellular and molecular biology, and plant biology that seeks an understanding of basic mechanisms underlying the effects of gravity. Studies may include animals, plants, tissues, or cells. Note that assurance of compliance with applicable federal regulations regarding human subjects and/or animal care and use is required as part of the proposal submission process (see the “Special Matters” instructions in Appendix E). Researchers are encouraged to take advantage of the various

transgenic and mutant species as well as comparative biology approaches that may enhance their research scope. NASA continues to value ground-based research that leads to flight experiments that can confirm or refute the fidelity of ground-based models and hypotheses. It is anticipated that research in cell and molecular biology (to include microbiology) will be emphasized in the utilization flights that are planned for the International Space Station. Please refer to Appendix D for a list of hardware that will be available for research.

Program Emphasis for FY 1997

This section describes the disciplines and research emphases within the Space Biology Program for FY 1997. Proposals are especially encouraged in developmental biology, and cellular and molecular biology.

Developmental Biology. NASA's goals in developmental biology are to determine the mechanisms by which gravity induces normal development and function; how gravity affects the capacity of animal species to reproduce; and the mechanisms by which subsequent generations are affected by gravity. Proposals which use different gravitational states to elucidate the effects of gravity during animal development are encouraged. Research in developmental biology should be focused on the **influence of hypergravity and microgravity on animal growth, development, reproduction, genetic integrity, life span, senescence, and subsequent generations of animals.** A pressing issue concerning developmental biology in space is whether an organism can undergo a complete life cycle in microgravity conditions. Examples of suitable molecular and genetic model systems for use in developmental studies are *Drosophila* and *Caenorhabditis elegans*, and rats or mice for developmental neurobiology.

Cellular and Molecular Biology. Proposals elucidating the mechanism(s) for gravity sensitivity in cells, unicellular organisms, or organized structural and functional units of multicellular biological systems are encouraged. Research into the influence of gravity on biological functions at the cellular level should be focused on identifying **how cells perceive gravity.** This may include the interactions of gravity with environmentally mediated effects. The goals should be to determine how gravitational information is transduced in cells; how cells respond to both acute and long-term variations in gravity; and the role of gravity on the cytoskeleton, ion channels, and function of cells. For example, research might focus on determining the role gravity plays on cellular responses to growth factors, or how it affects the three-dimensional microenvironment of the cell with respect to information content within the cell.

Plant Biology. The program in plant biology focuses on the characterization and explanation of the effects of gravity on the growth, development, composition,

and functions of higher plants. Goals are to determine: how plants perceive, transduce, and respond to a gravitational force; the role of hypergravity and hypogravity in plant developmental and reproductive processes, as well as in metabolic and transport processes in plants; and how gravity and other environmental stimuli interact. This year, to achieve balance within the program, proposals are sought that emphasize the specific area of **plant metabolism**.

B. SPACE PHYSIOLOGY AND COUNTERMEASURES

Program Description

The current goals of the Space Physiology and Countermeasures Program are: (1) to identify and characterize the physiological changes in humans that threaten to limit the duration of human space missions and to determine the mechanisms associated with these changes; and (2) to develop countermeasures that allow humans to live and work in microgravity, minimize the risks that are part of the readaptation process upon return to Earth's gravity, and optimize crew safety, well-being, and performance. The emphasis of the ground-based component of this research program is changing from the study of the acute problems of short-term space flight to the study of problems associated with the extended periods of flight that are characteristic of International Space Station missions or of missions to more remote regions of the solar system. The Space Physiology and Countermeasures Program supports basic and applied research utilizing hypogravity and hypergravity models and includes human subjects as well as other animal models. Note that assurance of compliance with applicable federal regulations regarding human subjects and/or animal care and use is required as part of the proposal submission process (see the "Special Matters" instructions in Appendix E).

Removal of the force of gravity results in structural and functional changes, especially in weight-bearing muscle, bone, and connective tissue. Muscles lose protein, size, and strength and undergo changes in metabolism, neuromuscular control and individual muscle fiber characteristics. The investigation of human muscles is particularly challenging because they are composed of various percentages of fast and slow fiber types arranged in a mosaic. There are muscles of lower vertebrates, on the other hand, that are composed predominantly of fast or slow fibers, thus simplifying interpretation of experimental results. Space flight has been shown to make muscle more susceptible to damage. Results obtained from animals sacrificed during the flight of SLS-2, however, indicate that the muscle damage does not occur during exposure to microgravity or space flight per se, but occurs during re-ambulation after returning to Earth's gravity. Similar changes have been reported in humans following unilateral lower limb suspension. In these studies, exercise performed by the unloaded limb at a

fraction of the workload it was capable of prior to the intervention appears to make the muscle of that limb more susceptible to damage than is the muscle of the contralateral weight-bearing limb. MRI evaluation suggests more muscle is recruited in the previously unloaded limb than the weight bearing limb to handle the same relative workload.

Bones lose calcium and strength and undergo changes of the matrix. The prolonged hypercalciuria increases potential for formation of renal stones. Changes also occur in other connective tissues. Although it is well documented that these changes occur, few data are available that describe the time course or magnitude of these changes in normal, healthy individuals. Moreover, the few clinical studies that have found similar changes in patients after bedrest have failed to elucidate the processes or underlying mechanisms responsible for the deleterious changes, probably because there are usually confounding factors.

Cardiovascular function is significantly changed during space flight, and orthostatic intolerance is a problem for astronauts returning from stays in microgravity as evidenced by responses to the postflight stand tests. Identifying the underlying mechanisms for orthostatic intolerance is complicated by the fact that, in addition to the cardiovascular deconditioning that occurs during space flight, the astronauts don suits that impose thermal stress, fluid load in an attempt to improve plasma volume, inflate anti-G trousers, and are exposed to increased cabin temperatures prior to landing. Recent reports have indicated that control of the cardiovascular responses is complicated by interactions between autonomic and neurovestibular influences. The integration of these systems must be investigated.

Stimulation of gravity receptors and proprioceptors, and nervous system interpretation and processing of the afferent input are changed immediately upon exposure to microgravity and again upon reexposure to gravity. Changes also occur in general sensorimotor function, including neuromuscular function; and postural instability is evident after flight. In addition, there are changes during space flight in the endocrine, hematological, immunological, metabolic, nutritional and gastrointestinal, renal, sleep, circadian, and temperature regulation systems, as well as in pharmacokinetics.

How any and all of these changes progress with flight duration is not well defined. As astronauts undertake longer tours of duty, multiple trips in space, and missions to more remote settings changes can become more pronounced and may even result in pathological conditions. Bone loss and muscle atrophy are expected to be among the most serious problems for extended-duration space flight, and exercise protocols and other countermeasures will be required as part of an effort to mitigate these symptoms. Cardiovascular response to

microgravity and on return to the Earth's gravitational force must be understood. Metabolic changes, including calcium metabolism, fluid and electrolyte balances, immunological changes, nutritional factors, and endocrine function also pose potential problems for crew health in extended-duration space flight. The effectiveness of drugs may be different in non-Earth gravitational states.

Program Emphasis for FY 1997

In general, proposals are requested that investigate the underlying **mechanisms** of the changes discussed above, that develop **countermeasures** to prevent or minimize undesirable responses to microgravity, or that enhance recovery and physiological readaptation following space flight. This general request includes proposals that utilize human and/or appropriate animal subjects and encourages proposals for the **integrated study of the responses of several physiological systems to hypogravity and hypergravity states**.

*Proposers interested in submitting proposals related to **countermeasures** should submit a comprehensive plan to develop ground-tested countermeasure by the end of the grant period. A schedule/milestone chart for the development of the delivered countermeasure, including a description of any special hardware to be delivered and protocols required for implementation, **must** be a part of the grant application for full consideration.*

For FY 1997, emphasis in the Space Physiology and Countermeasures Program will be on the development of **optimal inflight exercise protocol(s)** that will provide an effective, comprehensive **countermeasure for the musculoskeletal system** while minimizing the requirement for crew time. Proposals that provide a ground-tested countermeasure for the prevention of muscle and bone atrophy are particularly encouraged.

Proposals are particularly encouraged for ground-based research investigations designed to develop **resistive exercise countermeasures to protect muscle and/or bone** from the changes that occur during space flight and that could compromise performance upon return to Earth. The proposed research should establish a cause and effect relation that includes a detailed explanation of the underlying mechanisms that would be responsible for the success of a given treatment/countermeasure. Proposals should consider differences related to age, gender and fitness, and should be applicable to an astronaut population that includes men and women between the ages of 30-60 years. Specific areas of interest include:

- the mechanisms of bone remodeling, changes in bone matrix, pathogenesis and prevention of disuse osteoporosis;

- the different types of bones (i.e., compact vs. cancellous; axial vs. peripheral skeleton) that are particularly prone to change as a result of space flight;
- the mechanisms relating muscle activity to muscle mass and strength, motor unit activation, fiber-type expression, and resistance to fatigue;
- different types of muscle (fast vs. slow; weightbearing vs. non-weightbearing) that are particularly prone to change as a result of space flight;
- the relationship of muscle atrophy to bone loss;
- the identification of age-related and/or gender-specific changes in muscle or bone;
- noninvasive methods to accurately quantitate physical activity; muscle mass, strength, and function; neuromuscular activity; and bone size, resorption and formation, density, and strength; and
- efficient countermeasures, including identification of the stimulus for preventing the loss of muscle and bone tissue and function during space flight, that include exercise or exercise combined with pharmacological, electrical, hormonal, or mechanical interventions.

Proposals determining **basic mechanisms of physiologic responses** to hypergravity and simulated hypogravity using animal or human subjects will be considered. Outstanding proposals for ground-based research that address the effects of **vestibular/autonomic interaction as related to postflight orthostatic intolerance** are encouraged. No other types of ground-based research in neuroscience will be considered for funding in FY 1997 in the Space Physiology and Countermeasures Program because of current budgetary constraints. *Developmental neurobiology proposals should be submitted to the Space Biology Program (see Section III.A of this Appendix).*

Proposals in this research area for Small Payloads experiments should be consistent with the Program goals in animal and human physiology defined above; outstanding proposals using either human or animal subjects that will **advance our knowledge of the effects of space flight on humans** will be considered. Proposals for human studies may request that data be obtained before, during, or after a Space Shuttle mission. Applicants should carefully consider the constraints for Small Payload experiments (see Appendix D) in preparing their proposals.

Flight proposals for early utilization of Space Station (using the Human Research Facility) should address issues of critical basic physiology or operational importance and require the unique facilities and attributes of a Space Station. Potential applicants should note that extravehicular activity (EVA) is scheduled for these flights; studies that are related to the **effects of EVA on crewmembers**

and that can be performed within the constraints of Space Station are encouraged. Areas of importance include human factors and behavior (as affected by a culturally diverse crew, perturbed sleep-work cycles, etc.); cardiovascular function (including atrial bubble detection); muscle function, endurance, and biomechanics; energy balance; and, neuroscience research using the planned computer workstation (see Appendix D).

C. ENVIRONMENTAL HEALTH

Program Description

Safe air and water are essential for human life. NASA has the primary responsibility to ensure the health, preserve the safety, and enhance the performance of space crews during the human exploration of space. Thus, defining, creating, and maintaining a safe and habitable environment is an indispensable element of space travel. The unique characteristics of space flight confer additional importance upon a well-crafted plan for maintaining environmental safety. Exposure to microgravity and other flight-related stressors results in complex adaptational responses in any organism that evolved on Earth, including humans. The closed nature of the spacecraft environment means that microbial contamination must be minimized and any chemicals brought aboard or produced by human or microbial metabolism must not significantly contaminate the air or water supply. Moreover, crews are exposed continuously to many contaminants that are present for the duration of the mission. Water will be reclaimed from various onboard sources and treated and recycled for crew consumption. Finally, the severe constraints imposed on equipment weight, volume, and power limit assessments of habitability indicators as well as all but the simplest medical diagnosis and therapy in flight. It is clear that the complexity of spacecraft environments mandates a multidisciplinary approach to creating and maintaining a safe habitat. In addition, a well-controlled environment is essential to those who use the space laboratory for carefully controlled biological experiments.

To meet these challenges, the Environmental Health Program has established the following goals: (1) to understand the effects of the spacecraft environments on humans and other organisms; (2) to specify, measure, and control these environments; and (3) to develop standards and countermeasures, where necessary, to optimize crew health, safety, and productivity.

Research within the Environmental Health Program includes four interrelated disciplines, each dealing with a specific aspect of the spacecraft environment: barophysiology, microbiology, toxicology, and water quality. Research is necessary for the development of monitoring techniques, procedures, and

standards for extended missions aboard the space shuttle and the International Space Station. Note that assurance of compliance with applicable federal regulations regarding human subjects and/or animal care and use is required as part of the proposal submission process (see the “Special Matters” instructions in Appendix E).

Proposals related to the development of advanced environmental control and monitoring technologies should NOT be submitted to this Announcement, but should be submitted to the companion announcement, entitled “Advanced Life Support and Environmental Technologies for Human Exploration and Development of Space,” NRA 96-OLMSA-01B.

Program Emphasis for FY 1997

For FY 1997, the primary areas of emphasis for the Environmental Health Program include:

- determining the underlying mechanisms of decompression sickness in microgravity with the goal of minimizing prebreathe time;
- determining and understanding the effects of the spacecraft environment on the susceptibility of crewmembers to toxic chemicals in air or water;
- understanding the growth of microorganisms, their sensitivity to antibiotics, and human microbial interactions in space;
- assessing the impact of spacecraft microbial ecology on human health;
- determining the effects of potential spacecraft environmental and microbial growth on crew health and performance;
- developing disinfection techniques for recycled-water systems;
- developing special analytical procedures to identify and quantify the constituents of waste water and product water; and
- studying the effects of the interactions among gas composition, pressure, temperature, and humidity on the crew or on research specimens.

In general, research is encouraged that is relevant to the establishment of space flight environmental standards for human health and performance. Specifically, proposals are encouraged that:

- establish physiological norms for atmospheric gases in habitable and research spacecraft;
- identify airborne, waterborne or surface toxicants;
- describe microbial populations including their numbers, pathogenicity, or products;
- investigate optimal nitrogen washout protocols; and
- utilize ground-based studies to anticipate the effects of closed systems in space.

D. SPACE RADIATION HEALTH

Program Description

The space radiation environment consists of protons and electrons trapped in the Earth's magnetic field, protons (and some heavier particles) emitted in the course of solar energetic particle (SEP) events, and protons and the energetic nuclei of other elements (HZE particles) that constitute galactic cosmic rays (GCR). The SEP particles are mainly protons of energies up to several hundred MeV and intensities that can increase by four or five orders of magnitude within a few hours. The GCR particles have energies up to several thousand MeV per nucleon. The fluences of GCR nuclei vary slowly as a function of the solar cycle and of position in the interplanetary magnetic field. Average crew dose rates on the Shuttle have been measured to be in the range of approximately 0.03 to approximately 2.5 milliGray/day, depending on altitude and inclination, peaking to 3.6 milliGray/hour during passage of the South Atlantic Anomaly. These values are comparable to measurements reported on the Russian space station MIR. For the purposes of radiation protection, average quality factors, Q , have been evaluated using measured distributions of linear energy transfer (LET) and internationally recognized assumptions regarding the dependence of Q on LET. In low Earth orbit, average values of Q are in the range of 1.4 - 2; for the GCR component, the range of values is between 4 and 6.3.

The Space Radiation Health Program aims to establish the scientific basis for the radiation protection of humans engaged in the exploration of space, with particular emphasis on the knowledge base required to support future planetary exploration. Program objectives are to accurately predict the probabilities of deleterious health effects due to radiation exposure during human space activities (principally, but not exclusively, various types of cancer, in excess of natural incidence; effects on the nervous system; and effects on the length and quality of life). These predictions should be valid for any mission architecture, behind any shielding or structural materials, at any time in the solar cycle. Finally, this research is expected to lead to the timely development of countermeasures (evasion strategies, shielding design, and, eventually, intervention and treatment techniques for management of unplanned radiation exposures).

In pursuit of these objectives, the program emphasizes ground-based studies using accelerated beams of high energy protons and nuclei to simulate space radiation. Energetic beams of protons and of some of the nuclei found in GCR are available at ground-based laboratories. The beams can be used to simulate components of the space radiation environment in order to acquire the necessary database, study basic mechanisms of biological responses to radiation, explore potential preventive or recovery-enhancing countermeasures and develop effective

dosimetry. NASA has signed agreements with Loma Linda University Medical Center related to the use of proton beams and with Brookhaven National Laboratory for the use of heavy ion beams at the Alternating Gradient Synchrotron (further details are provided in Appendix C). *NASA negotiates beam delivery directly with these institutions and investigators proposing to use these irradiation facilities should not include the cost of beam time in their budgets. However, investigators should include the cost of carrying out the experiments at the beam site, including travel.*

Investigators are not required to use these facilities; but, if exposures at other facilities are needed for proposed studies, proposers must justify their use. *If exposures not available at Loma Linda or Brookhaven are needed for studies proposed in response to this NRA, proposers must indicate in their application how such exposures will be accomplished, provide evidence that the sources will be available for their use and indicate how the dosimetry and other physical characteristics of the radiation fields will be measured. The appropriate user fees also need to be included in the investigator's budget.*

The Program encompasses the following scientific areas: (a) Interaction of radiation with matter (e.g., shielding, tissue). This area encompasses research into the physics of the space radiation environment and of its modification by spacecraft, habitats, tissues and other materials; (b) Risk assessment standards. Current methods of risk assessment are based on the use of dose equivalent, the product of dose and quality factor. HZE particles can result in biological damage for which this approach may not be adequate. For this reason, direct methods of risk prediction are also supported; and (c) Radiation biology. Radiation biology comprises the research needed with cells, tissues, or animals to understand the basic mechanisms involved in the responses of living systems to radiation exposure and to develop methods to eventually prevent or limit the consequences to human health. These program areas should not be construed to be all inclusive. Scientifically important and highly relevant innovative research that is not mentioned explicitly will be considered. Note that assurance of compliance with applicable federal regulations regarding human subjects and/or animal care and use is required as part of the proposal submission process (see the "Special Matters" instructions in Appendix E).

Program Emphasis for FY 1997

Emphasis of the research program in FY 1997 will be on **ground-based experimental radiobiology studies using proton and high-energy heavy ion beams** in the energy range corresponding to space radiation. A very strong rationale will be required to justify support of studies not directly using protons or heavy ions in the relevant energy range, or not directly relevant to the

interpretation of experiments already conducted at such facilities. Those projects that can also lead to space-flight investigations are encouraged.

Proposals are particularly encouraged in the following areas:

- The highest priority will be assigned to studies leading to significant advances in our understanding of the **mechanisms of radiation damage and repair in cells and tissues**, especially studies likely to result in opportunities for the development of prevention or intervention **countermeasures in humans**, and studies linking biological mechanisms to patterns of energy deposition by high-energy charged particles. Topics of particular interest include the relationships between cellular death, repair, transformation and cancer, cell to cell communication and signal transduction.
- Investigations leading to significant improvements in **space radiation dosimetry**, especially those addressing a better understanding of current discrepancies between different measurements and between measurements and models. Not more than one study of this kind is expected to be selected, and particular weight will be given to the extent to which the principal investigator is able to ensure international collaboration.
- Investigations of fundamental mechanisms or measurements of basic physics data on the **nuclear interaction of radiation with novel shielding materials**, especially shielding materials and configurations likely to be important in the shielding of spacecraft and space habitats. No more than two studies of this kind are expected to be selected.

Proposals in the area of genomic instability will not be considered for funding under this NRA. NASA and the National Cancer Institute are currently developing a separate, jointly funded program to support this type of research and expect to issue a joint research solicitation in 1996.

E. BEHAVIOR AND PERFORMANCE

Program Description

The Behavior and Performance Program is designed to integrate knowledge about human capabilities into mission and spacecraft design, mission planning and execution, and related ground operations. The Program develops new processes and procedures, draws on human factors expertise in aeronautics to optimize crew training, automated systems design, proficiency and productivity, and uses relevant analog studies in simulators as well as in extreme and isolated environments. It also addresses psychosocial and cross-cultural aspects of human missions in space. Interested prospective proposers should note that Space Human

Factors Engineering is addressed in the companion Announcement *Advanced Life Support and Environmental Technologies for Human Exploration and Development of Space*, NRA 96-OLMSA-01B. Note that assurance of compliance with applicable federal regulations regarding human subjects and/or animal care and use is required as part of the proposal submission process (see the “Special Matters” instructions in Appendix E).

This Program supports both scientific and technical activities. Potential applicants should refer to Section VI.A of this Appendix for definitions related to proposals for each of these activities. The Program is organized around four major goals, each representing a distinct focus: expand knowledge of human psychological and physical capabilities and limitations in space; develop cost-effective technologies that support integrating the human and system elements of space flight; ensure that mission planners use human factors research results and technology developments to increase mission success and crew safety; and make NASA technology available to the private sector for Earth applications.

Potential applicants should note that all proposals submitted to this Program should include a section that addresses how any proposed technological development may be integrated into current or future NASA technology development projects. It is recommended that investigators selected for funding establish contact with appropriate personnel at the NASA center involved in their field of technology development or research.

Program Emphasis for FY 1997

To be considered for funding in FY 1997, scientific proposals for fundamental research should be directed toward one or more of the following objectives:

- Identifying and defining behavior and performance functions that are critical to safety;
- Determining long-term individual and group performance responses to space (physical, cognitive, perceptual, psychosocial and cross-cultural);
- Identifying critical factors affecting those responses and understanding underlying mechanisms involved in behavior and performance;
- Determining human habitability requirements for space flight;
- Developing and using ground-based models and analogs for studying space-related behavior and performance; and
- Identifying and evaluating behavior and performance research and technologies that have applications beyond the space program.

For FY 1997, technical proposals to undertake research applications should concentrate on the following areas:

1. Human-machine Function Allocation. The increasing complexity of automation in human-machine systems raises many human factors issues. Specific needs include: cognitive analysis of new systems to ensure that human and machine are able to function knowledgeably and cooperatively and that task allocation is appropriate; and requirements and guidelines for designing interfaces and modes of human-machine interaction, as well as training approaches and procedures to guide the use of such systems.
2. Interaction Among Intelligent Agents. Human interactions, with other humans and with intelligent machines, become increasingly important as missions become more diverse and longer in duration. Current knowledge in this area of human-factors analysis is very limited. Research is needed to understand the complexity of relationships among intelligent agents, focusing on psychosocial factors, group dynamics, multicultural issues, information transfer, and determinants of performance effectiveness in such teams.
3. Intravehicular (IVA) and Extravehicular Activity (EVA). Major concerns include sensory/perceptual, cognitive or personality issues, mental or emotional fatigue. Input from psychophysics, physical, cognitive, personality, emotional and mental work capacity measurement instruments, and unit and team task analysis can help to establish guidelines for a range of activities including: command and control structure and interactions, workplace layout, human-machine interfaces, work protocol, ground and space based selection and training.
4. Analog Studies. Earth-based testing and training facilities are crucial to the design, development and maintenance of space human-machine systems. Research in high-fidelity mockups and training simulators and in general environmental analogs are necessary for space missions. Analog studies should enhance human performance in operational procedures for both in-flight and ground-support personnel. The emphasis in this NRA is on the behavior and performance side of the equation.

At an appropriate point in the development of this research and after suitable evaluation, the appropriate NASA field center will become increasingly involved in the application or technology development, in order to ensure that requirements for future use are being addressed. Finally, research or applications advancing to a near flight-ready stage will be tested first in

integrated ground-based systems and then in flight as appropriate to ensure their efficacy prior to becoming incorporated into flight experiments or flight systems.

F. ADVANCED TECHNOLOGY DEVELOPMENT

Program Description

The Advanced Technology Development (ATD) Program develops technologies that will enable new space life sciences investigations, significantly improve the science return of existing investigations, minimize cost, schedule and program risk to life sciences flight experiments and, wherever possible, ensures that these technologies find application in the commercial sector. The ATD Program thus sponsors technology development activities that:

- Enhance the capability, reliability or quality of life sciences flight hardware;
- Solve technical problems that currently limit science return from existing flight equipment and from dependence on use of flight crew time;
- Enable new types of scientific investigations in space not presently possible;
- Promote technology transfer of life sciences technology to industry; and/or
- Establish partnerships with industry, universities and other agencies to facilitate technology development and transfer, both into and out of NASA.

The ATD Program supports only those generic technology definition and development proposals that have application across several scientific disciplines or programs. Technology development proposals that are specifically focused on one particular program should be submitted under that particular program. Proposals that are selected will be funded through the phase of initial demonstration of feasibility and suitability for use in the ground-based or flight programs (the breadboard demonstration stage). Once a sufficient level of maturity is demonstrated, further development (e.g., packaging or brass boarding) becomes the responsibility of the benefiting ground-based or flight project.

Potential applicants should note that all proposals submitted to the ATD Program should include a section that addresses how the proposed technological development may be integrated into current or future NASA technology development projects, and a section that discusses potential earth benefits of the proposed work, including but not limited to technology transfer to the commercial sector, potential benefits to medical sciences and technology, and potential general benefits to human welfare.

Program Emphasis for FY 1997

For FY 1997, the primary emphasis of the ATD Program will be on advanced hormone, pH or electrolyte sensors, as described below. New proposals in this area will have the highest programmatic priority. Proposals are also sought for development of technologies in the area of development or refinement of methods for dry and/or non-frozen storage of biological samples

Additionally, other innovative technology development proposals not specifically addressed in the above mentioned areas will also be funded if exceptional benefits to future space life sciences investigations can be demonstrated.

The following additional information describes technology needs for FY 1997 in more detail.

1. Advanced Hormone, pH or Electrolyte Sensors. Sensor technologies are needed for real-time or near real-time detection of hormones, immune system compounds such as immunoglobulins, pH and electrolytes. Any proposed sensors and sensor systems should either (preferably) interface with advanced biotelemetry systems under development by the Advanced Technology Development - Biosensors project at NASA Ames Research Center, or be stand-alone (e.g., as in the swallowable pill-type monitoring systems). Proposed sensors and systems must be biocompatible with humans and animals and should be operable without recalibration for extended durations (e.g., for the duration of a typical International Space Station mission).
2. Methods for Dry and/or Non-frozen Storage of Biological Samples. NASA is interested in methods for dry and/or non-frozen storage of biological specimens that minimize the requirement for refrigeration and freezing of biological samples. The methods of greatest interest will be simple to use, compatible with microgravity and will offer long-duration (6 months or longer) storage capabilities.

The ATD Program solicits scientific and technical proposals that are highly innovative and, although based upon sound principles, may contain some risk of failure. Bold, novel approaches to solving technology needs are encouraged. At an appropriate point in the development of these technologies and after suitable evaluation, the appropriate NASA field center will become increasingly involved in the technology development, in order to ensure that requirements for future use are being addressed in the technology development effort. Finally, technologies advancing to a near flight-ready stage will be tested first in

integrated ground-based systems and then in flight as appropriate to ensure their efficacy prior to becoming incorporated into flight experiments or flight systems.

G. DATA ANALYSIS

Program Description

The Data Analysis Program supports a range of activities that are focused on carrying out a thorough analysis of data gathered during space flight and its Earth analogs, including both studies that actually analyze existing data and studies that aim to develop new techniques that may be applied to biological data.

Extended data analysis activities seek to examine, from a fresh perspective, data and samples that have already been collected during space flight or one of its analogs and subjected to primary analysis by the original principal investigator. Detailed new analyses of data extracted from the **Life Sciences Data Archive** or of specimens obtained from the **Biospecimen Sharing Program** are examples of extended data analysis tasks. In addition, proposals by a space flight experiment investigator to extend the scope of the postflight data analysis beyond that contained either in the original flight proposal or as negotiated during the flight experiment definition phase are appropriate extended data analysis activities.

The Program also supports the development of **special data analysis techniques** that promise to strengthen the analysis of data from space flight, such as mathematical modeling, computer simulation, artificial intelligence, or statistical methods. These high technology tasks generally require sophisticated computer manipulation of data in order to enhance the value of the data to the investigator.

Program Emphasis for FY 1997

For FY 1997, the primary emphasis of the Data Analysis Program will be on **extended data analysis** and new proposals in this area will have the highest programmatic priority. Secondary emphasis will be on the area of special data analysis techniques. Proposers should note that the information and data contained in the Life Sciences Data Archive (see information on the World Wide Web at <http://nssdc.gsfc.nasa.gov.life>) may be used as the basis for all or part of an extended or special data analysis proposal.

IV. BIOSPECIMEN SHARING PROGRAM

The Biospecimen Sharing Program provides the scientific community with access to NASA's inventory of biological materials from organisms that have flown in space. These materials were not required by the primary experiments of previous space flights; the available material often includes material from appropriate flight and/or ground control studies that were designed to enable the primary investigation to be carried out successfully. Applicants may submit proposals specifically for analysis of materials obtained from this Program (requesting funding through the Data Analysis Program above) or as an adjunct or supplementary component of an experimental proposal in one of the other research areas above. In either case, it is expected that the use of the requested materials will be fully justified in the proposal. Applicants should indicate their requirement for materials at the appropriate place on Form B (Appendix E) and should note that there will be no additional investigator costs required to obtain these materials.

Previously Collected Materials. Rodent, bird, and plant materials are currently available from previously flown flight experiments. Specific information regarding which samples are still available; characteristics of each mission from which the samples were obtained (e.g., mission length and orbital inclination); experimental conditions used to obtain and preserve the samples; and protocols (e.g., diet, light/dark cycle, housing, fixation/storage) followed by the primary investigation from the samples derived can be obtained by contacting

Mr. Marc Shepanek
UL/Life Sciences Division
NASA Headquarters
Washington, DC 20546
(202) 358-2530
(202) 358-4168 (Fax).

V. FLIGHT EXPERIMENTS

Proposals for space-flight experiments may be submitted in response to this Announcement if they involve either of two special types of scientific studies:

1. Experiments, called **Small Payloads Experiments**, that can be implemented (primarily on the Shuttle middeck) without the use of major mission resources; or
2. Experiments that can be implemented with the limited resources available on the **International Space Station** during the early assembly (construction) phase (1998-1999).

Both of these experiment types are highly constrained in a number of ways (described below); *proposals requiring resources beyond the capabilities defined below should NOT be submitted in response to this Announcement.*

Potential applicants should recognize that, given the limited flight opportunities that are available at present, the flight experiments area is likely to be one of the most competitive arenas within the space life sciences for FY 1997. It is expected that successful flight experiment proposals will represent mature studies strongly anchored in previous or current ground and/or flight research. Ground-based research may, and often must, represent one component of a flight experiment proposal, but that research should be limited to activities that are essential for the final development of an experiment for flight and for the completion and publication of the scientific results of the experiment. In this case, only one (flight) proposal need be submitted. Preparatory ground research designed to define a mature space experiment should be proposed separately and in its own right as part of the ground-based program.

Note that all flight experiments must address one or more of the research programs and emphases defined in Section III above. Applicants proposing flight experiments must fill out the information required on Form E (Appendix E).

Finally, potential applicants should be aware that selection for flight is a multi-step process. Following the initial evaluation of flight proposals, a small group of investigators will receive a letter informing them that their experiment has been selected for definition. During the definition phase, NASA will interact with the applicant and determine whether the proposed experiment can actually be carried out on a space mission. At the end of this phase, NASA will select a smaller group of investigations to be developed for flight. **Normally, investigator funding does not begin until the initiation of the development phase.**

A. SMALL PAYLOADS EXPERIMENTS

Small payloads proposals submitted in response to this Announcement are restricted to experiments that can be accommodated in the middeck area of the Shuttle and that use existing flight hardware. The Shuttle middeck consists of "lockers" inside the Shuttle crew cabin that can house the specimens, hardware, and/or apparatus necessary for experiment completion. The experiments themselves are usually stand-alone studies that require limited crew training and involvement to execute. It is possible to take advantage of the location in the Shuttle middeck to obtain late preflight installation and early postflight retrieval of materials.

Hardware that will be available to support the small payload flight experiment opportunities with non-human subjects are as follows: Plant Growth Facility (PGF), Aquatic Research Facility (ARF), and Biological Research in Canisters (BRIC). Descriptions of these hardware items, as well as others that may be used to support experiments, are included in Appendix D. It is expected that small payload opportunities will also exist for the use of human (crew) subjects. Detailed descriptions of available hardware to support these experiments are also included in Appendix D. Note that the number of crew subjects available to support such studies will be limited due to both the late manifesting of middeck experiments and the limited amount of crew time historically available to support the middeck experiments. However, preflight and postflight studies of the crew are possible in a limited number of cases.

Investigators may propose to use one or more pieces of flight certified hardware to implement their experiment, or may propose to utilize their own currently existing flight hardware. Proposals for the development of experiment unique equipment to implement individual experiments are not encouraged. However, when exceptional circumstances justify the need for such equipment, such items should be proposed as new developments and the additional costs should be included in the proposal as specified in Appendix B.

Applicants should note that small payloads experiments should be proposed as if the actual flight of the experiment occurred in 1998 or 1999. Experiments that cannot be accomplished within this time period should not be proposed to this Announcement. With strong justification, applicants may request multiple flight opportunities; however, preference will be given to those proposals requesting only one flight to accomplish the proposed research.

Once selected, flight investigators and NASA must agree on the duration of the period (nominally one year) following receipt of specimens and data during which their investigation will be completed. At the end of this period, investigators must provide a final report to NASA and should make the results of their experiments known to the scientific community through publication in appropriate peer reviewed journals. All suitable experimental and reduced data must be submitted to NASA in a form appropriate for archiving in the Space Life Sciences Data Archive, where it will be available to the scientific community.

B. SPACE STATION EARLY UTILIZATION

Research opportunities will exist during the construction phase of the International Space Station. These opportunities will include durations longer than the current Shuttle limit of approximately 16 days, but will be constrained in a variety of other ways. Research opportunities will be available during

utilization flights when the Shuttle visits the Space Station, and during the time period between the utilization flights when the permanent onboard crew will act as experiment operators and, if necessary, as subjects. The duration of microgravity exposure during the 1998-99 time frame can, in theory, be indefinite with periodic disturbances every 30 days caused by the U.S. and Russian transportation vehicle docking activities. The primary opportunities to transport scientific equipment, supplies, and samples will be on the utilization flights of Shuttle; however, modest capabilities for research related deliveries and sample return will be available on assembly flights that take place every 40-90 days. Two utilization flights are presently planned during 1998-99, one in February 1999 and one in July 1999.

Potential applicants should refer to Appendix D for a description of the accommodations available. During this period, space life sciences research is restricted to utilize a limited hardware set prior to delivery of the U.S. laboratory module in 1998, followed by the availability of early configurations of two facilities: the Biological Space Research Facility (BSRF) and the Human Research Facility (HRF). **Applicants should be aware of the fact that extravehicular activity (EVA) is scheduled for these flights;** this requires the atmospheric pressure in both the Shuttle and the Space Station to be reduced to 10.4 psi for 24 to 48 hours. Proposers should consider the potential impact of such reduced pressure on their investigations. In addition, it is expected that **crew availability for science operations will be limited** throughout 1998-99. Proposers who can submit experiments with few and/or simple inflight activities are likely to be more easily accommodated. Finally, it should be noted that the informed consent of human subjects must be obtained prior to carrying out any study in space and potential proposers should be aware that obtaining such informed consent will involve a uniform process regardless of country of origin of the proposer. The following is a draft of the consent form currently under development for the International Space Station. This is provided for information purposes only and should not be submitted at this time as part of an application.

DRAFT
MULTINATIONAL SPACE STATION
HUMAN RESEARCH INFORMED CONSENT*

1. I, the undersigned, do voluntarily give my informed consent for my participation as a test subject in the following research study, test, or investigation:

NAME OF INVESTIGATION _____

MISSION TO WHICH ASSIGNED _____

PRINCIPAL INVESTIGATOR _____

RESPONSIBLE PROJECT SCIENTIST _____

I understand or acknowledge that:

- (a) This procedure is part of an investigation approved by participating agencies.
- (b) I am performing these duties as part of my employment with _____.
- (c) This research study has been reviewed and approved by the Multinational Review Board (MRB) which has also determined that the investigation involves _____ risk to the subject. (minimal or reasonable)
- (d) Definitions:
“Minimal risk” means that the probability and magnitude of harm or discomfort anticipated in the research are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests.

“Reasonable risk” means that the probability and magnitude of harm or discomfort anticipated in the research are greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests, but that the risks of harm or discomfort are considered to be acceptable when weighed against the anticipated benefits and the importance of the knowledge to be gained from the research.
- (e) The research procedures were explained to me prior to the execution of this form. I was afforded an opportunity to ask questions, and all questions asked were answered to my satisfaction. A layman’s description was provided to me.**
- (f) I consider myself physically and mentally qualified to participate in the investigation.
- (g) I know that I can refuse to participate in the tests at any stage of their performance, and my refusal will be honored, except in those cases when, in the opinion of the responsible physician, termination of the tests could have detrimental consequences for my health and/or the health of the other subjects. However, understanding the significance of the investigations (tests), I will give every effort to perform the full scope of the program.
- (h) In the event of injury resulting from this study, I understand that I will receive medical attention and necessary treatment. I also understand that I will be compensated for any injuries to the

extent permitted under current _(TBD)_ and the provisions of the contract between _(TBD)_. My agreement to participate shall not be construed as a release of _(TBD)_ or any third party from any future liability which may arise from, or in connection with, the above procedures.

- (I) Consistent with statutory and Agency-approved routine uses under the _(TBD)_, the confidentiality of any data obtained as a result of my participation as a research subject in this study shall be maintained, so that no data may be linked with me as an individual. However, if a “life-threatening” abnormality is detected, the investigator will notify me and the _(TBD)_. Such information may be used to determine the need for care or medical follow-up, which, in certain circumstances, could affect my professional (flight) status.

Test Subject

Date

2. I, the undersigned, the Principal Investigator of the investigation designated above, certify that:

- (a) I have accurately described the procedure and related risk(s) to the test subject.
- (b) The test setup involves _____ risk to the test subject as determined by the MRB.
(minimal or reasonable)
- (c) All equipment to be used has been inspected and certified for safe and proper operation.
- (d) The test subject is qualified to participate in my experiment protocol.
- (e) The test protocol has not been changed from that originally approved by the MRB.

Principal Investigator

Date

Concurrence:

Project Scientist

Date

Notes:

* This form is valid for the period including preflight, in-flight, and postflight data collection sessions for the mission. Before the first baseline data collection, the Principal Investigator will repeat the briefing concerning risks involved in the investigation. A signed, dated copy of this form with attachments must be forwarded to Chair, Multinational Review Board.

** A detailed description of the investigation will be attached to this consent form. The Principal Investigator is responsible for formulating this document, which should be in layman’s terms such that the subject clearly understands what procedures will be required and the risks associated therewith. The detailed description of the research procedures must specifically list the risks associated with the procedures to be employed, the possible adverse reactions of all medications to be administered, and the risks/hazards resulting from exposure to ionizing radiation. Further, the investigator must clearly specify all forms of subject behavior interdicted by the research protocol (exercise, diet, medications, etc.).

Pre-U.S. Laboratory Module

The International Space Station will have a permanent crew beginning in 1998, approximately six months prior to the assembly of the U.S. laboratory module and 10 months prior to the first utilization flight. During this time period, an extremely limited set of research equipment will be available. However, because of the presence of the crew and the expected availability of a small amount of crew time for research purposes, it is possible to carry out certain restricted kinds of investigations. Available equipment may include crew exercise devices, cardiovascular monitoring devices and other hardware described in Appendix D.

Biological Space Research Facility

During this early (construction) phase of the International Space Station, biological research with non-human specimens will be possible, focusing on opportunities in cell and molecular biology. NASA hardware, such as the Incubator, Cell Culture Unit (CCU), and the Standard Interface Glovebox (SIGB), will be available for experimentation. Additional hardware currently under development by the international partners may also be available for use, including: STATEX, the Aquatic Research Facility (ARF), and NIZEMI. More detailed hardware specifications can be found in either Appendix D, or from the Space Station Biological Research Project World Wide Web page (<http://pyroeis.arc.nasa.gov/>). Specimens which can be supported include: single-cell prokaryotic and eucaryotic organisms; various types of cell cultures; small aquatic animals and insects; and small plants.

Human Research Facility

There will also be opportunities for human research during these early utilization flights. These studies will utilize equipment that is located in the early elements of the Human Research Facility (HRF), a suite of generic life sciences laboratory equipment designed to support a multidisciplinary research program. See Appendix D for a description of the hardware items included in HRF Rack #1, which is currently scheduled for launch in 1999, and additional stowable hardware that does not use power. Applicants should propose to utilize that hardware in carrying out their investigations.

It is expected that competitive proposals will address issues of critical basic physiological or operational importance and will require the unique facilities or attributes of a space station (microgravity exposure in excess of 16 days) for their completion. As noted earlier, the experimental concept must have evolved from

a clearly defined and rigorous program of successful ground-based or space-flight investigations.

Emphasis during this early utilization period will be on research that is operationally simple or, at least, relatively easy to perform, and that involves minimal crew training and minimal crew time during flight.

VI. PROPOSAL EVALUATION AND AWARDS SELECTION PROCESS

The following information is specific to this NRA and **supersedes** the information contained in Appendix B (Instructions for Responding to NASA Research Announcements for Solicited Research Proposals), Sections 13 and 14.

A. EVALUATION FACTORS

The principal elements considered in the evaluation of proposals received in response to this NRA are: **overall scientific/technical value** of the proposed research; **relevance of the proposed activity to the research emphases** defined in this Announcement and to the Human Exploration and Development of Space Strategic Plan; and **cost**. In addition, space flight proposals and proposals to utilize special NASA ground-based facilities will be evaluated for the feasibility of actually implementing the proposed projects utilizing the requested flight hardware or ground facilities. The weight assigned to each of these elements is determined by the type of proposal being evaluated. For scientific proposals, overall scientific value will be given the greatest weight, followed by smaller weights for relevance and cost, in that order. For technical proposals, overall technical value and relevance will have approximately equal weight, followed by a smaller weight for cost.

For the purposes of this Announcement, scientific proposals should be differentiated from technical proposals by two characteristics: the underlying objective of the proposal and the method proposed for reaching that objective. Scientific proposals generally have, as their primary objective, the development of new knowledge through the scientific method (i.e., through the development and testing of a scientific hypothesis). Technical proposals, on the other hand, usually have the development of technologies or processes as their primary objective, and propose engineering methods, evaluations, and trade studies to reach their objective. It is the responsibility of each applicant to determine whether their submitted proposal is scientific or technical; NASA reserves the right to reclassify submissions prior to review.

For those proposals for which implementation feasibility is necessary to assess, it will be given a weight equal to that of overall scientific/technical value. Within each of these elements, the following factors are critical to the proposal evaluation and awards selection process:

1. Overall Scientific/Technical Value

- Clarity of the project's hypotheses and objectives;
- Feasibility of the approach and adequacy of the methods and procedures to carry out the proposed project;
- Innovation of the research design;
- Originality of the proposed project;
- Likelihood that the proposed project will lead to new discoveries or fundamental advances within its field;
- Likelihood that the proposed project will lead to new technologies that contribute to NASA's mission or to the health and welfare of the American people;
- Familiarity of investigators with the relevant published literature;
- Background and documented experience and skills of the investigators as an indication of their ability to accomplish the proposed activity;
- For flight investigations, documented adequacy of maturity of the proposed project (i.e., Is project scientifically/technically ready for flight or is further development required?);
- Availability of the investigators to devote adequate time and effort to the project;
- Adequacy of institutional resources, facilities, and equipment to support proposed research;
- Overall standing among similar proposals available for evaluation and/or evaluation against the known state-of-the-art.

2. Relevance

- Likelihood that accomplishing the proposed project will contribute meaningfully to progress in at least one of the research emphases in this Announcement;
- Impact of the proposed research on programmatic progress in addressing one of the defined research emphases of this Announcement;
- Potential that accomplishing the proposed project will significantly enhance the productivity and/or cost effectiveness of ground or space operations.

3. Implementation Feasibility (Not applicable to all proposals)
 - Ability to implement the proposed project utilizing the flight and/or ground facilities available.
4. Cost
 - Appropriateness of the budget, including the realism and reasonableness of the proposed cost and the relationship of the proposed cost to available funds.

B. EVALUATION TECHNIQUES

Upon receipt, proposals will be reviewed for compliance with the requirements of this Announcement. All compliant proposals, regardless of type, will undergo merit review by a panel of experts. The number of experts required will be determined by the response to this NRA and by the variety of disciplines represented in the proposals relevant to the research emphasis described in Section III of this Appendix. An engineering and technical review will be conducted by an appropriate engineering evaluation team for those proposals that require the determination of the feasibility of implementing the proposed projects utilizing available flight and/or ground facilities. Following these reviews, NASA program managers will prepare a selection plan for each program described in this Announcement. This plan will be based on: (1) the ratings and evaluations of the panels of experts according to the above criteria; and (2) the contribution of each proposal to the development of a sound scientific/technical research program having the appropriate balance of tasks required by the critical research issues confronting the program as determined by the Human Exploration and Development of Space Strategic Plan. This selection plan will be presented by the program managers to the Life Sciences Management Council, a group of senior NASA managers in the space life sciences. Following acceptance of the plan by the Council, selection for funding will be made by the Director of the Life Sciences Division.

VII. PROGRAM MANAGEMENT INFORMATION

A. TYPE OF AWARDS TO BE MADE

The award instrument will be appropriate to the submitting institution. NASA will fund the institution one year at a time. It is expected that such funding will continue for a total period of from one to four years, depending on the proposal requirement, the recommendation of the review panels, and the continuing programmatic contribution of the activity. The number of proposals selected for support will depend on the quality of the proposals received and the availability

of funds. However, it is anticipated that approximately 50 awards averaging \$125,000 (total costs) annually will be made, although the total annual cost may vary from \$15,000 to \$350,000. The appropriate program managers of NASA's Life Sciences Division will have a primary role in oversight of these awards, and will be responsible for annually evaluating their progress and out-year plans.

B. ELIGIBILITY

All categories of institutions and scientists are eligible to submit proposals in response to this NRA. Multi-institutional consortium arrangements also are eligible: the applying entity may collaborate with universities, Federal Government laboratories, private sector, and state and local government laboratories. In all such arrangements, the applying entity is expected to be responsible for administering the project according to the management approach presented in the proposal.

The applying entity must have in place a documented base of ongoing high quality research in science and technology, or in those areas of science and engineering clearly relevant to the specific programmatic objectives and research emphases indicated in this Announcement. Present or prior support by NASA of research and/or training in any institution or for any investigator is neither a prerequisite to submission of a proposal nor is it a competing factor in the selection process.

C. FOREIGN PROPOSALS

NASA will accept proposals from all countries in response to this Announcement. Proposals from non-U.S. entities should not include a cost plan. Non-U.S. proposals and U.S. proposals that include non-U.S. participation must be endorsed in writing by the respective government agency or funding/sponsoring institution in that country from which the non-U.S. participant is proposing. Such written endorsement should indicate that:

- (1) The proposal merits careful consideration by NASA; and,
- (2) If the proposal is selected, sufficient funds will be made available to undertake the activity as proposed.

In addition to sending the original (signed) proposal and twenty (20) copies to NASA through Information Dynamics, Inc., as directed in the next section, **one (1) additional copy along with the Letter of Endorsement must be forwarded to:**

**Ms. Ruth Rosario
IH/Space Flight Division
Ref: NRA 96-OLMSA-01A
NASA Headquarters
Washington, DC 20546-0001
USA**

All proposals must be typewritten in English. **All non-U.S. proposals will undergo the same evaluation and selection process as those originating in the U.S.** Non-U.S. proposals and U.S. proposals that include non-U.S. participation must follow all other guidelines and requirements described in this NRA. All proposals must be received before the established closing date. Those received after the closing date will be treated in accordance with NASA's provisions for late proposals. Successful and unsuccessful proposers will be contacted directly by the NASA Program Office coordinating this Announcement. Copies of these letters will be sent to the sponsoring government agency.

Should a non-U.S. proposal or a U.S. proposal with non-U.S. participation be selected, NASA's Space Flight Division (Mail Code: IH) will arrange with the non-U.S. sponsoring agency for the proposed participation on a no exchange of funds basis, in which NASA and the non-U.S. sponsoring agency will each bear the cost of discharging its respective responsibilities. Depending on the nature and extent of the proposed cooperation, these arrangements may entail:

- (1) A letter of notification by NASA; and/or
- (2) An exchange of letters between NASA and the sponsoring governmental agency.

D. PROGRAM REPORTING

Applicants should note that investigators selected from proposals submitted in response to this Announcement will be expected to provide NASA with annual summary information about their projects. This information will consist primarily of an abstract, bibliographic list, copies of publications, and a statement of progress. This information will be made available to the scientific community and will be used to assess the strength of the Division's programs. Note that although this publication will be made available to the general scientific community, it is not a substitute for traditional scientific reporting in journals and elsewhere.

Investigators selected to carry out space-flight experiments must also provide NASA with two special reports:

1. A "quick-look" report of preliminary flight results that is due one month after the space flight takes place;

2. A final report containing all data and information on the flight study due approximately one year after all required data is provided by NASA to the investigator. At this time, all of the data must also be provided to NASA for placement in the Life Sciences Data Archive; data in this archive will be made available to the scientific community.

Additional information may be required of investigators at the time of their annual funding renewal.

E. DEADLINES

To facilitate proposal processing, potential principal investigators are requested to confirm plans to submit a proposal responding to this Announcement by sending a **letter of intent to propose**, which is not binding, by 4:30 PM EDT, Monday, April 15, 1996. The letter of intent, which should be no more than two pages, should contain:

- The names, addresses, and telephone numbers of a single principal investigator and all co-investigators;
- A title descriptive of the research or technical proposal;
- A brief summary describing the proposed research, indicating clearly the research program(s) defined in this Announcement that are most relevant to the proposal;
- The major participating institutions; and
- Up to six (6) key words that best describe the research area of the pending proposal. Refer to Form B in Appendix E for a list of acceptable key words.

Letters of intent may be submitted through the U.S. Postal Service or commercial delivery services in the same manner as proposals, described below. In addition, letters of intent may be submitted electronically via e-mail or World Wide Web to the following addresses:

E-mail: loi@gm.olmsa.hq.nasa.gov

World Wide Web: <http://peer1.idi.usra.edu>

An original signed proposal, plus twenty (20) complete copies of that proposal, must be received by 4:30 PM EDT, Wednesday, May 15, 1996.

Proposals and letters of intent mailed through the U.S. Postal Service by express, first class, registered, or certified mail are to be sent to the following address:

Information Dynamics, Inc.
SUBJECT: NASA Life Sciences Research Proposal
300 D Street SW
Suite 801
Washington, DC 20024.

Proposals and Letters of Intent hand delivered or sent by commercial delivery or courier services are to be delivered to the above address between the hours of 8:00 AM and 4:30 PM. The telephone number (202) 479-2609 may be used when required for reference by delivery services.

Note that Information Dynamics, Inc. (IDI) cannot receive deliveries on Saturdays, Sundays, or federal holidays.

F. PROPOSAL SCHEDULE

The following schedule is planned for the acquisition of investigations under this Announcement:

- Letter of Intent to Propose Due April 15, 1996
- Proposal Due May 15, 1996
- Selection Announcement October- November 1996
- Initial Funding Available October 1996 - September 1997

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 - b. **Environmental Health Discipline Science Plan**, Environmental Health Program (1991). (NTIS #N9321369 - \$17.50)
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 - f. **Space Biology: Cell Biology Discipline Plan**, Space Biology Program (1993).
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 - a. **Research Opportunities in Cardiovascular Deconditioning: Final Report Phase I.** 1983. M. N. Levy and J. M. Talbot (Eds.). NASA Contractor Report 3707. (*NTIS #N8329992* - \$26.00)
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 - c. **Research Opportunities in Bone Demineralization: Final Report Phase III.** 1984. S. A. Anderson and S. H. Cohn (Eds.). NASA Contractor Report 3795. (*NTIS #N8427417* - \$26.00)
 - d. **Final Report Phase IV. Research Opportunities in Muscle Atrophy.** 1984. G. J. Herbison and J. M. Talbot (Eds.). NASA Contractor Report 3796. (*NTIS #N8427416* - \$26.00)
 - e. **Research Opportunities in Immunocompetence in Space.** 1985. W. R. Beisel and J. M. Talbot (Eds.). NASA Contractor Report 176482. (*NTIS #N8621138* - \$25.00)
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 - g. **Research Opportunities in Loss of Red Blood Cell Mass in Space Flight.** 1985. J. M. Talbot and K. D. Fisher (Eds.). Contract Number NASW3924. (*NTIS #N8527517* - \$25.00)
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 - a. **Space Human Factors Publications: 1980-1990.** 1991. K. J. Dickson (Ed.). NASA Contractor Report 4351. (*NTIS # N9120620* - \$22.00)
 - b. **Publications of the Space Physiology and Countermeasures Program, Regulatory Physiology Discipline: 1980-1990.** 1992. J. W. Robinson, K. J. Dickson, E. Hess, and J. V. Powers (Eds.). NASA Contractor Report 4469. (*NTIS #N9233657* - \$34.50)
 - c. **Publications of the Space Physiology and Countermeasures Program, Musculoskeletal Discipline: 1980-1990.** 1992. E. Hess, J. W. Robinson, K. J. Dickson, and J. V. Powers (Eds.). NASA Contractor Report 4468. (*NTIS #N9312898* - \$34.50)

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 - f. **Publications of the Environmental Health Program: 1980-1990.** 1992. J. W. Robinson, E. Hess, and K. J. Dickson (Eds.). NASA Contractor Report 4455. (*NTIS #N9229341 - \$19.50*)
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* *Obtaining cited papers:*

Many of the documents may be ordered through your library or through the National Technical Information Service (NTIS). Documents available through NTIS are accompanied by their NTIS order number and price. To order a document through NTIS, call (703) 487-4650. If you are unable to locate a document through this means, please contact Information Dynamics, Inc. at (202) 488-5157.

APPENDIX B

**INSTRUCTIONS FOR RESPONDING TO
NASA RESEARCH ANNOUNCEMENTS
FOR SOLICITED RESEARCH PROPOSALS**

1. FOREWORD

a. NASA depends upon industry, educational institutions and other nonprofit organizations for most of its research efforts. While a number of mechanisms have been developed over the years to inform the research community of those areas in which NASA has special research interests, these instructions apply only to "NASA Research Announcements," a form of "broad agency announcement" described in 6.102(d)(2) and 35.016 of the Federal Acquisition Regulation (FAR). The "NASA Research Announcement (NRA)" permits competitive selection of research projects in accordance with statute while at the same time preserving the traditional concepts and understandings associated with NASA sponsorship of research.

b. These instructions are Appendix I to 18-70.203 of the NASA Federal Acquisition Regulation Supplement.

2. POLICY

a. NASA fosters and encourages the submission of research proposals relevant to agency mission requirements by solicitations, "NASA Research Announcements," which describe research areas of interest to NASA. Proposals received in response to an NRA will be used only for evaluation purposes.

b. NASA does not allow a proposal, the contents of which are not available without restriction from another source, or any unique ideas submitted in response to an NRA to be used as the basis of a solicitation or in negotiation with other organizations, nor is a pre award synopsis published for individual proposals.

c. A solicited proposal that results in a NASA award becomes part of the record of that transaction and may be available to the public on specific request; however, information or material that NASA and the awardee mutually agree to be of a

privileged nature will be held in confidence to the extent permitted by law, including the Freedom of Information Act.

3. PURPOSE

These instructions are intended to supplement documents identified as "NASA Research Announcements." The NRAs contain programmatic information and certain "NRA-specific" requirements which apply only to proposals prepared in response to that particular announcement. These instructions contain the general proposal preparation information which applies to responses to all NRAs.

4. RELATIONSHIP TO AWARD

a. A contract, grant, cooperative agreement, or other agreement may be used to accomplish an effort funded on the basis of a proposal submitted in response to an NRA. NASA does not have separate "grant proposal" and "contract proposal" categories, so all proposals may be prepared in a similar fashion. NASA will determine the appropriate instrument.

b. Grants are generally used to fund basic research in educational and nonprofit institutions, while research in other private sector organizations is accomplished under contract. Additional information peculiar to the contractual process (certifications, cost and pricing data, facilities information, etc.) will be requested, as necessary, as the procurement progresses. Contracts resulting from NRAs are subject to the Federal Acquisition Regulation and the NASA FAR Supplement (NHB 5100.4). Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NHB 5800. 1).

5. CONFORMANCE TO GUIDANCE

a. NASA does not have any mandatory forms or formats for preparation of responses to NRAs; however, it is requested that proposals conform to the procedural and submission guidelines covered in these instructions. In particular, NASA may accept proposals without discussion; hence, proposals should initially be as complete as possible and be submitted on the proposers' most favorable terms.

b. In order to be considered responsive to the solicitation, a submission must, at a minimum, present a specific project within the areas delineated by the NRA; contain sufficient technical and cost information to permit a meaningful evaluation; be signed by an official authorized to legally bind the submitting organization; not merely offer to perform standard services or to just provide computer facilities or

services; and not significantly duplicate a more specific current or pending NASA solicitation. NASA reserves the right to reject any or all proposals received in response to an NRA when such action is considered in the best interest of the Government.

6. NRA-SPECIFIC ITEMS

- a. Several proposal submission items will appear in the NRA itself. These include: the unique NRA identifier; when to submit proposals; where to send proposals; number of copies required; and sources for more information.
- b. Items included in these instructions may be supplemented by the NRA, as circumstances warrant. Examples are: technical points for special emphasis; additional evaluation factors; and proposal length.

7. PROPOSAL CONTENTS

- a. The following general information is needed in all proposals in order to permit consideration in an objective manner. NRAs will generally specify topics for which additional information or greater detail is desirable. Each proposal copy shall contain all submitted material, including a copy of the transmittal letter if it contains substantive information.

b. Transmittal Letter or Prefatory Material

- (1) The legal name and address of the organization and specific division or campus identification if part of a larger organization;
- (2) A brief, scientifically valid project title intelligible to a scientifically literate reader and suitable for use in the public press;
- (3) Type of organization e.g., profit, nonprofit, educational, small business, minority, women-owned, etc.;
- (4) Name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation;
- (5) Identification of any other organizations that are currently evaluating a proposal for the same efforts;
- (6) Identification of the specific NRA, by number and title, to which the proposal is responding;

(7) Dollar amount requested of NASA, desired starting date, and duration of project;

(8) Date of submission; and

(9) Signature of a responsible official or authorized representative of the organization, or any other person authorized to legally bind the organization (unless the signature appears on the proposal itself).

c. Restriction on Use and Disclosure of Proposal Information

It is NASA policy to use information contained in proposals for evaluation purposes only. While this policy does not require that the proposal bear a restrictive notice, offerors or quoters should, in order to maximize protection of trade secrets or other information that is commercial or financial and confidential or privileged, place the following notice on the title page of the proposal and specify the information subject to the notice by inserting appropriate identification, such as page numbers, in the notice. In any event, information (data) contained in proposals will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice.

NOTICE

Restriction on Use and Disclosure of Proposal Information

The information (data) contained in [insert page numbers or other identification] of this proposal constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed other than for evaluation purposes; provided, however, that in the event a contract (or other agreement) is awarded on the basis of this proposal the Government shall have the right to use and disclose this information (data) to the extent provided in the contract (or other agreement). This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

d. Abstract

Include a concise (200-300 word, if not otherwise specified in the NRA) abstract describing the objective of the proposed effort and the method of approach.

e. Project Description

(1) The main body of the proposal shall be a detailed statement of the work to be undertaken and should include objectives and expected significance; relation to the present state of knowledge in the field; and relation to previous work done on the project and to related work in progress elsewhere. The statement should outline the general plan of work, including the broad design of experiments to be undertaken and an adequate description of experimental methods and procedures. The project description should be prepared in a manner that addresses the evaluation factors in these instructions and any additional specific factors in the NRA. Any substantial collaboration with individuals not referred to in the budget or use of consultants should be described. Note, however, that subcontracting significant portions of a research project is discouraged.

(2) When it is expected that the effort will require more than one year for completion, the proposal should cover the complete project to the extent that it can be reasonably anticipated. Principal emphasis should, of course, be on the first year of work, and the description should distinguish clearly between the first year's work and work planned for subsequent years.

f. Management Approach

For large or complex efforts involving interactions among numerous individuals or other organizations, plans for distribution of responsibilities and any necessary arrangements for ensuring a coordinated effort should be described. Aspects of any required intensive working relations with NASA field centers that are not logical inclusions elsewhere in the proposal should be described in this section.

g. Personnel

The principal investigator is responsible for direct supervision of the work and participates in the conduct of the research regardless of whether or not compensation is received under the award. A short biographical sketch of the principal investigator, a list of principal publications and any exceptional qualifications should be included. Omit social security number and other personal items which do not merit consideration in evaluation of the proposal. Give similar biographical information on other senior professional personnel who will be directly associated with the project. Give the names and titles of any other scientists and technical

personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants, together with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

h. Facilities and Equipment

(1) Describe available facilities and major items of equipment especially adapted or suited to the proposed project, and any additional major equipment that will be required. Identify any government-owned facilities, industrial plant equipment, or special tooling that are proposed for use on the project.

(2) Before requesting a major item of capital equipment, the proposer should determine if sharing or loan of equipment already within the organization is a feasible alternative to purchase. Where such arrangements cannot be made, the proposal should so state. The need for items that typically can be used for both research and non-research purposes should be explained.

i. Proposed Costs

(1) Proposals should contain cost and technical parts in one volume: do not use separate "confidential" salary pages. As applicable, include separate cost estimates for salaries and wages; fringe benefits; equipment; expendable materials and supplies; services; domestic and foreign travel; ADP expenses; publication or page charges; miscellaneous identifiable direct costs; and indirect costs. List salaries and wages in appropriate organizational categories (e.g., principal investigator, other scientific and engineering professionals, graduate students, research assistants, and technicians and other non-professional personnel). Estimate all manpower data in terms of man-months or fractions of full-time.

(2) Explanatory notes should accompany the cost proposal to provide identification and estimated cost of major capital equipment items to be acquired; purpose and estimated number and lengths of trips planned; basis for indirect cost computation (including date of most recent negotiation and cognizant agency); and clarification of other items in the cost proposal that are not self-evident. List estimated expenses as yearly requirements by major work phases. (Standard Form 1411 may be used).

(3) Allowable costs are governed by FAR Part 31 and the NASA FAR Supplement Part 18-31 (and OMB Circulars A-21 for educational institutions and A-122 for nonprofit organizations.)

j. Security

Proposals should not contain security classified material. However, if the proposed research requires access to or may generate security classified information, the submitter will be required to comply with applicable Government security regulations.

For other current projects being conducted by the principal investigator, provide title of project, sponsoring agency, and ending date .

k. Special Matters

(1) Include any required statements of environmental impact of the research, human subject or animal care provisions, conflict of interest, or on such other topics as may be required by the nature of the effort and current statutes, executive orders, or other current Government-wide guidelines.

(2) Proposers should include a brief description of the organization, its facilities, and previous work experience in the field of the proposal. Identify the cognizant Government audit agency, inspection agency, and administrative contracting officer, when applicable.

8. RENEWAL PROPOSALS

a. Renewal proposals for existing awards will be considered in the same manner as proposals for new endeavors. It is not necessary that a renewal proposal repeat all of the information that was in the original proposal upon which the current support was based. The renewal proposal should refer to its predecessor, update the parts that are no longer current, and indicate what elements of the proposal are expected to be covered during the period for which extended support is desired. A description of any significant findings since the most recent progress report should be included. The renewal proposal should treat, in reasonable detail, the plans for the next period, contain a cost estimate, and otherwise adhere to these instructions.

b. NASA reserves the right to renew an effort either through amendment of an existing contract or by a new award.

9. LENGTH

Unless otherwise specified in the NRA, every effort should be made to keep proposals as brief as possible, concentrating on substantive material essential for a complete understanding of the project. Experience shows that few proposals need exceed 15-20 pages. Any necessary detailed information, such as reprints, should be included as attachments rather than in the main body of the proposal. A complete set of attachments is necessary for each copy of the proposal. As proposals are not returned, avoid use of "one-of-a-kind" attachments: their availability may be mentioned in the proposal.

10. JOINT PROPOSALS

a. Some projects involve joint efforts among individuals in different organizations or mutual efforts of more than one organization. Where multiple organizations are involved, the proposal may be submitted by only one of them. In this event, it should clearly describe the role to be played by the other organizations and indicate the legal and managerial arrangements contemplated. In other instances, simultaneous submission of related proposals from each organization might be appropriate, in which case parallel awards would be made.

b. Where a project of a cooperative nature with NASA is contemplated, the proposal should describe the contributions expected from any participating NASA investigator and agency facilities or equipment which may be required. However, the proposal must be confined only to that which the proposing organization can commit itself. "Joint" proposals which purport to specify the internal arrangements NASA will actually make are not acceptable as a means of establishing an agency commitment.

11. LATE PROPOSALS

A proposal or modification thereto received after the date or dates specified in an NRA may still be considered if the selecting official deems it to offer NASA a significant technical advantage or cost reduction.

12. WITHDRAWAL

Proposals may be withdrawn by the proposer at any time. Offerors are requested to notify NASA if the proposal is funded by another organization or of other changed circumstances which dictate termination of evaluation.

13. EVALUATION FACTORS

a. Unless otherwise specified in the NRA, the principal elements (of approximately equal weight) considered in evaluating a proposal are its relevance to NASA's objectives, intrinsic merit, and cost.

b. Evaluation of a proposal's relevance to NASA's objectives includes the consideration of the potential contribution of the effort to NASA's mission.

c. Evaluation of its intrinsic merit includes the consideration of the following factors, none of which is more important than any other:

(1) Overall scientific or technical merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal.

(2) The offerors capabilities, related experience, facilities, techniques, or unique combinations of these which are integral factors for achieving the proposal objectives.

(3) The qualifications, capabilities, and experience of the proposed principal investigator, team leader, or key personnel who are critical in achieving the proposal objectives.

(4) Overall standing among similar proposals available for evaluation and/or evaluation against the known state-of-the-art.

d. Evaluation of the cost of a proposed effort includes the consideration of the realism and reasonableness of the proposed cost and the relationship of the proposed cost to available funds.

14. EVALUATION TECHNIQUES

Selection decisions will be made following peer and/or scientific review of the proposals. Several evaluation techniques are regularly used within NASA. In all cases, however, proposals are subject to scientific review by discipline specialists in the area of the proposal. Some proposals are reviewed entirely in-house where NASA has particular competence; others are evaluated by a combination of in-house people and selected external reviewers, while yet others are subject to the full external peer review technique (with due regard for conflict-of-interest and protection of proposal information), such as by mail or through assembled panels. Regardless of the technique, the final decisions are always made by a designated NASA selecting official. A proposal which is scientifically and programmatically

meritorious, but which is not selected for award during its initial review under the NRA may be included in subsequent reviews unless the proposer requests otherwise.

15. SELECTION FOR AWARD

a. When a proposal is not selected for award, and the proposer has indicated that the proposal is not to be held over for subsequent reviews, the proposer will be notified that the proposal was not selected for award. NASA will notify the proposer and explain generally why the proposal was not selected. Proposers desiring additional information may contact the selecting official who will arrange a debriefing.

b. When a proposal is selected for award, negotiation and award will be handled by the procurement office in the funding installation. The proposal is used as the basis for negotiation with the submitter. Formal RFPs are not used to obtain additional information on a proposal selected under the NRA process. However, the contracting officer may request certain business data and may forward a model contract and other information which will be of use during the contract negotiation.

16. CANCELLATION OF NRA

NASA reserves the right to make no awards under this NRA and, in the absence of program funding or for any other reason, to cancel this NRA by having a notice published in the Commerce Business Daily. NASA assumes no liability for canceling the NRA or for anyone's failure to receive actual notice of cancellation. Cancellation may be followed by issuance and synopsis of a revised NRA, since amendment of an NRA is normally not permitted.

SPECIAL RESEARCH FACILITIES

This Appendix provides a list of the special research facilities available to investigators for ground research at one of the NASA Field Centers or at other sites. Detailed descriptions of these research facilities can be found in the reference document entitled *Special Research Facilities for Space Life Sciences*. This document is available on the World Wide Web at the following address:

<http://peer1.idi.usra.edu/>

or it may be obtained by calling Information Dynamics, Inc. at
202-488-5157
and requesting a printed copy.

Potential applicants should contact persons identified in those facility description for additional technical information. The cost of using these facilities should be included in any proposal requiring them; such costs should be approved in advance by the contact persons listed there.

AMES RESEARCH CENTER

1. The Vestibular Research Facility (VRF)
 - Ground-based multi-axis centrifuge,
 - 12- Foot linear spring sled,
 - 30- Foot Sled, and
 - Portable linear sled.

2. Human Rated Hypergravity Facilities
 - 20-G Centrifuge,
 - Human-Carrying Rotation Device (HCRD), and
 - Human Powered Centrifuge.

3. Non-Human Hypergravity Facilities
 - 24-Foot Diameter Centrifuge,
 - 8-Foot Diameter Centrifuge, and
 - Hypergravity Facility for Cell Culture (HyFaCC).

4. The Biocomputation Center
- Zeiss 902 Transmission Electron Microscope
 - Workstations for computation, 3-D simulation, and visualization

JOHNSON SPACE CENTER

- The KC-135 "Zero-g" aircraft

BRANDEIS UNIVERSITY

- Slow Rotation Test Facility

GROUND-BASED ACCELERATOR FACILITIES

- Loma Linda University Medical Center (protons with energies between 70 and 250 MeV)
- Alternating Gradient Synchrotron (AGS) at Brookhaven National Laboratory (beams of iron and other heavy nuclei, with energies as low as 1 GeV/nucleon, up to 10 GeV/nucleon)

MICROGRAVITY USER SUPPORT CENTER, KÖLN, GERMANY

- Fast rotating clinostats;
- Cuvette clinostats;
- STATEX hardware;
- BIOLABOR double rack (DARA hardware);
- Low Rotating Centrifuge Microscope (NiZeMi lab model);
- Cultivation chambers for Biorack containers Type I and NiZeMi;
- Different centrifuges including large centrifuge;
- Large-scale Magnetic Resonance device (imaging, microscopy and spectroscopy);
- Tilting microscope;
- Data and image processing capabilities;
- Computer-based fluorescence microscopy (Zeiss Attofluor); and
- Laboratories and sophisticated workshops also for electronics.

APPENDIX D
NRA 96-OLMSA-01A

FLIGHT EXPERIMENT ACCOMMODATION

This Appendix contains a technical description of the accommodation constraints imposed by the Shuttle middeck on Small Payloads Experiments and of the constraints of the International Space Station on Space Station Early Utilization Experiments. In addition, a list is provided of space-flight equipment that will be available on each platform during the time period covered by this Announcement. Detailed descriptions of the equipment listed below can be found in the reference document entitled *Flight Experiment Hardware for Space Life Sciences*. This document is available on the World Wide Web at the following address:

<http://peer1.idi.usra.edu/>

or it may be obtained by calling Information Dynamics, Inc. at
202-488-5157

and requesting a printed copy.

Applicants may propose to utilize the flight-certified hardware from these lists to implement their experiment or they may propose to utilize their other existing, available hardware. Applicants are not encouraged to propose the development of experiment unique equipment at this time.

I. SHUTTLE MIDDECK ACCOMMODATIONS

The middeck area in the Shuttle Orbiter cabin currently accommodates up to 42 standard middeck storage lockers. Normally, after the primary payloads and support equipment have been defined for a Shuttle flight, up to six middeck lockers remain available for Small Payloads Experiments and other middeck activities. A typical Small Payloads Experiment requires one or two lockers; however, other configurations (e.g., half of a locker) are possible.

A. VOLUME AND STRUCTURAL INTERFACE

A standard locker is 20.3 in deep, 17.3 in wide, and 10.0 in high, and provides two cubic feet of volume. Investigators may use the standard lockers to "stow" their experiments and related equipment or, if necessary, may fabricate similar containers with greater strength or rigidity. Experiments may also be mounted directly to adapter plates that occupy the same bulkhead space as one or two lockers.

B. WEIGHT

A standard middeck experiment is defined as not to exceed 54 pounds when stowed in a single locker. If the experiment is not stowed, and is mounted to adapter plates, the experiment maximum weight is based upon the experiment's center-of-gravity.

C. SAFETY

Because the middeck experiments are carried out inside the crew cabin, safety is of paramount importance. There are stringent requirements concerning flammability, odor, and offgassing of materials used in the Orbiter cabin. Surface touch temperatures of middeck equipment are not to exceed 113° F. Other limitations relate to sharp edges, center of gravity, volume, and protrusion into the cabin area. The specific requirements are established in Shuttle/Payload Interface Definition Document for Middeck Accommodations (refer to NASA document NSTS-21000-IDD-MDK).

D. POWER AND THERMAL (ENVIRONMENTAL)

In the middeck, the Orbiter can provide both 28V DC and 115V AC (although AC power is not available to experiments during ascent) to an experiment. Continuous power (power during Shuttle ascent and descent) may be provided to an experiment, but this resource is extremely limited. An experiment can also provide its own power supply (i.e., alkaline batteries). Maximum power normally available per middeck experiment is 130 watts. Experiments that have a DC power requirement greater than 130 watts will have to compete for a limited number of flight resources.

In the Shuttle middeck area, experiment equipment waste heat is dissipated to the cabin air by means of passive cooling, or forced air cooling (i.e., an experiment provides an air circulation fan). The heat load in a standard locker can be up to 60 watts.

Crew cabin ambient air is 65-80° F under normal operations, and cabin O₂ is 25.9% at 14.7±0.2 psia (cabin pressure). Sometimes, a flight may have extravehicular activity (EVA) procedures; as a result, cabin pressure is reduced to 10.2±0.5 psia, and cabin O₂ is 30.0% maximum. Extremely sensitive samples need to be identified as such so that their location can be considered during the flight definition.

E. ACCESS

Sometimes investigators have a requirement for access to their experiments as close as possible to launch. (For example, to load live specimen such as seedlings, sea urchins, or rodents.) The latest time to have access is up to 14 hours before a Shuttle launch. The critical late access window for a middeck experiment is between 24 and 14 hours before a launch. An experiment turnover occurs before late access installation into the Shuttle middeck. Experiments which can be installed in the middeck as early as possible (i.e., days before a launch) will have an easier time being placed on a mission. Also, if experiments have requirements to retrieve samples as soon as possible after landing, the earliest access is three hours after landing.

F. DATA ACQUISITION

There are no standard provisions for interfacing to the Shuttle data system for real-time data downlink. However, if a tape recorder or computer is needed, it may need to be provided by the user or, depending on the availability of support equipment, from the equipment inventory.

II. LIFE SCIENCES FLIGHT EQUIPMENT FOR SMALL PAYLOADS

The following items are available as flight-qualified hardware for use by applicants proposing Small Payloads Experiments. Since the development and acquisition of flight equipment is a continual process, prior to writing a proposal, potential applicants are advised to contact the Flight Experiments Program Manager (see page 3 of this Announcement) concerning the availability of other equipment not identified below, but required to carry out an investigation in space. **Note: items in this list marked by * may also be proposed to carry out experiments during all phases of early utilization of the International Space Station.**

- BIOLOGICAL RESEARCH IN CANISTERS (BRIC)*
- PLANT GROWTH FACILITY (PGF)
- GLOVEBAG KIT*
- HARVEST KIT
- FIXATIVE KIT*
- CELL CULTURE MODULE (CCM)
- AQUATIC RESEARCH FACILITY (ARF)
- FLIGHT SYRINGE UNIT
- AUTOGENIC FEEDBACK SYSTEM (AFS)*
- AUTOMATIC BLOOD PRESSURE SYSTEM (ABPS)

- ULTRASOUND LIMB PLETHYSMOGRAPH*
- VENOUS OCCLUSION CUFF AND CONTROLLER (VOCC)*
- ECHOCARDIOGRAPH
- INFLIGHT BLOOD COLLECTION SYSTEM (IBCS)
- HEMATOCRIT CENTRIFUGE*
- ORBITER CENTRIFUGE
- URINE MONITORING SYSTEM (UMS)*
- REFRIGERATOR/INCUBATOR MODULE (R/IM)
- TISSUE CULTURE INCUBATOR*
- LOWER BODY NEGATIVE PRESSURE DEVICE (LBNPD)
- ELECTROMYOGRAM (EMG) SIGNAL CONDITIONER*
- ELECTROCARDIOGRAPH SIGNAL CONDITIONER*
- ELECTRO-OCULOGRAPHIC (EOG) SIGNAL CONDITIONER*
- BICYCLE ERGOMETER

III. INTERNATIONAL SPACE STATION ACCOMMODATIONS

Since the both the International Space Station (ISS) and the experiment hardware systems are in development at the present time, some of the constraints defined here may change prior to actual experiment implementation; the constraints provided here are for planning purposes only. The ISS experiment hardware list provided in the next section of this Appendix (section IV) contains a brief technical summary of the known (or expected) equipment constraints associated with conducting research on the International Space Station during the early utilization period (1998-1999). During this period, most of the capability for life sciences research will be housed in the U.S. Laboratory module (US Lab), scheduled for launch in late 1998.

On-orbit resources, such as experiment power, thermal heat rejection, and crew time will be severely constrained in the early utilization time frame. Space Shuttle launch mass for payloads will also be extremely limited. Experiments employing simple, automated protocols designed for specific analyses after return to Earth and limited refrigeration/freezer use will be more likely to be accommodated than those employing complicated protocols. Results from these early operations should be used to develop a foundation for more complex scientific campaigns in the future.

Constraints also exist on the capability of transporting specimens to and from the Space Station. Two primary methods of transporting experiment specimens and

hardware are planned during the early utilization period. The first is transportation of hardware racks, passive (unpowered) experiments, and both passive and conditioned (refrigerated) storage in the Mini Pressurized Logistics Module (MPLM). For example, the incubators are planned to be transported in this carrier. However, access to the MPLM, once integrated into the Shuttle is limited. Frozen materials at -80°C that will be transported in the MPLM must be installed prior to 80 hours before the Shuttle launch. All other payload hardware systems must be transported unpowered.

The second transportation method available is in the Shuttle middeck. Sometimes access to the biological specimens prior to launch is required to be as late as possible to ensure specimen viability. Current planning allows for middeck late access, which must be completed before 14 hours prior to the Shuttle launch for CR/IMs or CCUs as discussed below.

Middeck access to returned samples from orbit is approximately three hours after landing. However, middeck space, as well as the late/early access capability, is limited, and experimenters are encouraged to investigate strategies that allow transport of specimens or media in a dormant or inactive state, and likewise, return preserved specimens in a stable condition. For materials returned within the -80°C freezer in the MPLM, access will be approximately five days following return for a nominal landing at KSC.

IV. SPACE STATION EXPERIMENT HARDWARE (EARLY UTILIZATION)

The following items are available as flight-qualified hardware for use by applicants proposing Space Station Early Utilization experiments. Since the development and acquisition of flight equipment is a continual process, prior to writing a proposal, potential applicants are advised to contact the Flight Experiments Program Manager (see page 3 of this Announcement) concerning the availability of other equipment not identified below, but required to carry out an investigation in space.

Four types of laboratory equipment will be available during the early utilization period of Space Station. First, a limited set of items will be available prior to the first Utilization Flight of the Shuttle (UF-1) (i.e., from May 1998 to February 1999). Beginning with UF-1, three other types of equipment will be available for research use. These types are: generic items, termed Laboratory Support Equipment (LSE), intended for use by a large number of experiments; items

contained in the initial configuration of the Biological Space Research Facility (BSRF); and items contained in the first set of equipment provided for the Human Research Facility (HRF).

A. EARLIEST UTILIZATION PHASE

The following hardware will be available from the initial time that the Space Station is permanently inhabited. Prior to the first Utilization Flight, currently planned for February 1999, this hardware is the only set of Space Station Hardware that will be available for scientific use. Applicants should note that certain items of equipment available for use on the Shuttle middeck may also be used on the International Space Station. These items, described in Section II of this Appendix, are marked by an * in that section; they may be proposed for use during any phase of Space Station activity.

- AEROBIC EXERCISE DEVICE (TREADMILL)
- AEROBIC EXERCISE DEVICE (ERGOMETER)
- RESISTIVE EXERCISE DEVICE (CONCENTRIC AND ECCENTRIC)

B. LABORATORY SUPPORT EQUIPMENT

- COMPOUND MICROSCOPE
- FREEZER (-80° C)
- REFRIGERATOR (4° C)
- CAMERA LOCKER
- FILM LOCKER
- STILL CAMERAS
- 35MM STILL CAMERAS AND ACCESSORIES

C. BIOLOGICAL SPACE RESEARCH FACILITY EQUIPMENT

The following items will be available in the initial outfitting of the Biological Space Research Facility (BSRF):

- COMMERCIAL REFRIGERATOR/INCUBATOR MODULE (CRIM)
- INCUBATOR
- STANDARD INTERFACE GLOVEBOX (SIGB)
- CELL CULTURE UNIT (CCU) (Not available until Utilization Flight 2 in late 1999)

D. HUMAN RESEARCH FACILITY EQUIPMENT

The following items are available at the initial outfitting of the Human Research Facility (HRF) and should be available from the first Utilization Flight, planned for February 1999.

- SAMPLE COLLECTION KITS
- INJECTION AND INFUSION SYSTEMS
- URINE COLLECTION SYSTEM
- HRF PORTABLE COMPUTER
- AMBULATORY DATA ACQUISITION SYSTEM
- PHYSIOLOGICAL SIGNAL CONDITIONER
- ULTRASOUND/DOPPLER FOR ECHOCARDIOGRAPHY, FLOW DETERMINATION, DEEP ORGAN AND MUSCLE/TENDON IMAGING
- BODY MASS MEASUREMENT DEVICE (SLMMD)
- CONCENTRIC, ECCENTRIC, AND ISOMETRIC STRENGTH MEASURING DEVICE
- GAS ANALYZER MASS SPECTROMETER (GASMAP)
- FOOT-GROUND INTERFACE (Flexible capacitors)
- HOLTER MONITOR
- CONTINUOUS BLOOD PRESSURE DEVICE
- PULSE OXIMETER
- LOWER BODY NEGATIVE PRESSURE DEVICE
- RESPIRATORY IMPEDANCE PLETHYSMOGRAPH (RIP)
- HAND-HELD ELECTRONIC LOGBOOK
- VIDEO SYSTEM
- HRF COMPUTER WORKSTATION
- RANGE OF MOTION SYSTEM (GONIOMETER)
- IMMUNIZATION KITS
- MANUAL BLOOD PRESSURE
- HAND GRIP DYNAMOMETER
- ACTIVITY MONITOR
- CENTRIFUGE

APPENDIX E
NRA 96-OLMSA-01A

**REQUIRED APPLICATION FORMS AND INSTRUCTIONS FOR
PROPOSAL PREPARATION**

Instructions for Proposal Preparation

| | |
|--------|--|
| Form A | Solicited Proposal Application |
| Form B | Proposal Summary |
| Form C | Detailed Budget, First Year |
| Form D | Detailed Budget, Entire Project Period |
| Form E | Space-Flight Experiment Supplementary Application Information (Optional) |
| Form F | Certification Regarding Drug-free Workplace Requirements |
| Form G | Certification Regarding Debarment, Suspension, and Other Responsibility Matters |
| Form H | Certification Regarding Lobbying |
| Form I | Checklist for Proposers |

INSTRUCTIONS FOR PROPOSAL PREPARATION

The information contained in these instructions is specific to this Announcement and supplements the general guidance provided in Appendix B.

All U.S. proposals should include one copy of each of the forms provided in this Appendix as part of the complete submission, with the exception of Form E that is submitted only with flight experiments. Non-U.S. proposals with no U.S. component are not required to submit Forms C, D, F, G, and H.

The proposal should include the following material, in this order:

- (1) Transmittal Letter;
- (2) Cover Page: Solicited Proposal Application (Form A);*
- (3) Proposal Summary (Form B);
- (4) Detailed Budget, 12 Month (Form C);
- (5) Detailed Budget, Entire Project Period (Form D);
- (6) Proposal Title Page, with Notice on Restriction on Use and Disclosure of Proposal Information, if any;
- (7) Project Description;
- (8) Space-Flight Experiment Supplementary Application Information (to be submitted with flight experiments only) (Form E);
- (9) Management Approach;
- (10) Personnel;
- (11) Facilities and Equipment;
- (12) Supporting Budgetary Information;
- (13) Special Matters (specific information on animal and/or human subjects protocol approval required, if applicable);*
- (14) Certification Regarding Drug-Free Workplace (Form F);*
- (15) Certification Regarding Debarment, Suspension, and Other Responsibility Matters (Form G);*
- (16) Certification Regarding Lobbying (Form H);*
- (17) Computer diskette (3.5 inch, Macintosh or PC format) containing an electronic copy of the principal investigator's name, address, telephone and Fax numbers, e-mail address, and the complete project title and abstract as provided on Form B;
- (18) Checklist for Proposers (Form I); and
- (29) Appendices, if any.

* One signed original required

Except for the Project Description Section, there is no specific page limitation on proposals submitted. However, every effort should be made to keep proposals as brief as possible. The name of the Principal Investigator should appear in the upper right hand corner of each page of the proposal, except on the Forms in this Appendix where special places are provided for this information. Note that the proposal must specify the period of performance for the work described; periods of performance may be for any duration up to four (4) years, but should be suitable for the project proposed.

TRANSMITTAL LETTER

The transmittal letter should contain, at least:

- (1) The legal name and address of the organization and specific division (or campus identification if part of a larger organization) that proposes to carry out the project;
- (2) A brief project title intelligible to a scientifically literate reader and suitable for use in the public press;
- (3) The name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation;
- (4) The identification of the specific NRA, by number and title, to which the proposal is responding; and
- (5) The signature of the responsible official or authorized representative of the organization, or any other person authorized to legally bind the organization.

A copy of the Checklist for Proposers (Form I) should be attached to this letter. Only one copy of the transmittal letter is required; it should be attached to the single original signature version of the submitted proposal.

COVER PAGE: SOLICITED PROPOSAL APPLICATION (FORM A)

The information on Form A must be filled out completely and one original signature version of this form should be submitted with the transmittal letter above.

For Item (7) on this form, new means that a proposal for this project has not been submitted to NASA in 1994 or 1995, renewal means that this proposal is for the continuation of an already funded task beyond the term of the funded proposal, and revised means that this proposal represents a revision of a proposal submitted to NASA in 1994 or 1995, but not funded. A proposal previously submitted but not funded should be termed revised even if the original principal

investigator has changed for 1996. Renewal and revised applications should contain special material described in the Project Description section, below.

Note that items (9) and (10) on Form A require assurance of compliance with human subject and/or animal care provisions of NASA regulations (see Special Matters section, below). Applicants should be aware that review of a proposal will not be undertaken without prior assurance of compliance.

PROPOSAL SUMMARY (FORM B)

The information requested on this form is essential to the review of the proposal. It determines how the application will be evaluated and which program manager(s) will receive the final review materials for possible inclusion in one of the research programs of the Division. Applicants are requested to classify their proposals as either scientific or technical. Scientific proposals should be differentiated from technical proposals by two characteristics: the underlying objective of the proposal and the method proposed for reaching that objective. Scientific proposals generally have, as their primary objective, the development of new knowledge through the scientific method (i.e., through the development and testing of a scientific hypothesis). Technical proposals, on the other hand, usually have the development of technologies or processes as their primary objective, and propose engineering methods, evaluations, and trade studies to reach their objective.

DETAILED BUDGET, 12 MONTH (FORM C)

DETAILED BUDGET, ENTIRE PROJECT PERIOD (FORM D)

These forms are self-explanatory budget forms that must be submitted with each U.S. proposal, or with non-U.S. proposals that have a U.S. component for which NASA funding is sought.

Foreign proposals with no U.S. component should not submit these forms, but, as explained in Appendix A, should be endorsed in writing by the respective government agency or funding/sponsoring institution in that country from which the non-U.S. participant is proposing. This endorsement should indicate that:

- (1) The proposal merits careful consideration by NASA; and,
- (2) If the proposal is selected, sufficient funds will be made available to undertake the activity as proposed.

PROPOSAL TITLE PAGE, WITH NOTICE ON RESTRICTION ON USE AND DISCLOSURE OF PROPOSAL INFORMATION, IF ANY

The title page should contain the project title, name and address of the submitting institution, the name, address and telephone number of the Principal Investigator, and the names and institutions of any co-investigators. It is NASA policy to use information contained in proposals for evaluation purposes only. While this policy does not require that the proposal bear a restrictive notice, offerors or quoters should, in order to maximize protection of trade secrets or other information that is commercial or financial and confidential or privileged, place the following notice on the title page of the proposal and specify the information subject to the notice by inserting appropriate identification, such as page numbers, in the notice. In any event, information (data) contained in proposals will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice.

NOTICE

Restriction on Use and Disclosure of Proposal Information

The information (data) contained in [insert page numbers or other identification] of this proposal constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed other than for evaluation purposes; provided, however, that in the event a contract (or other agreement) is awarded on the basis of this proposal the Government shall have the right to use and disclose this information (data) to the extent provided in the contract (or other agreement). This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

PROJECT DESCRIPTION

The length of the Project Description Section of the proposal should not exceed 25 pages using regular (12 point) type. The proposal should contain sufficient detail to enable a reviewer to make informed judgments about the overall merit of the proposed research and about the probability that the investigators will be able to accomplish their stated objectives with the resources requested and with their own resources. In addition, the proposal should indicate clearly the relationship between the proposed work and the research emphases defined in this Announcement. The project description should be consistent with the type of

proposal that is being submitted (ground-based research investigation or space-flight experiment). If an investigator wishes to propose related studies of two different types (e.g., a ground-based research investigation and a related space-flight experiment), then two proposals should be submitted with their linkage described in each proposal.

Renewal applications (for competing renewal of currently funded activity) must include a progress report as an Appendix to the proposal, and should refer to this Appendix appropriately throughout the Project Description section.

Revised applications (revisions of 1994 or 1995 submissions) must include, as part of the Project Description section, an **Introduction** that contains responses to the criticisms in the previous critique. Applicants should highlight the changes they have made in their research plan by appropriate bracketing, indenting, or changing of typography. Clearly present any work done since the prior version was submitted. Note that revised applications that do not address the criticisms in the previous critique and/or include substantial revisions may be penalized in the review process.

SPACE-FLIGHT EXPERIMENT SUPPLEMENTARY APPLICATION INFORMATION (Optional, FORM E)

All applicants proposing space research should fill out Form E. The information on this form is essential for the evaluation of the feasibility of carrying out the proposed study. Before filling out this form, applicants read Appendix D carefully and make certain that they understand the accommodation constraints that are associated with flight experiments. In addition, applicants should utilize available equipment to implement the proposed experiment (as listed in Appendix D), or should provide a low-cost available alternative. Failure to do this may preclude implementation of the experiment.

MANAGEMENT APPROACH

Each proposal must specify a single principal investigator who is responsible for carrying out the proposed project and coordinating the work of other personnel involved in the project. In proposals that designate several senior professionals as key participants in the research project, the management approach section should define the roles and responsibilities of each participant, and note the proportion

of each individual's time to be devoted to the proposed research activity. The proposal should state clearly and unambiguously whether these key personnel have reviewed the proposal and endorsed their participation.

PERSONNEL

The principal investigator is responsible for direct supervision of the work and participates in the conduct of the research regardless of whether or not compensation is received under the award. A short biographical sketch of the principal investigator that includes his/her current position title, educational background, a list of principal publications and any exceptional qualifications should be included. Omit social security number and other personal items which do not merit consideration in evaluation of the proposal. Give similar biographical information on other senior professional personnel who will be directly associated with the project. Give the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants, together with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

FACILITIES AND EQUIPMENT

Describe the available facilities and major items of equipment especially adapted or suited to the proposed project, and any additional major equipment that will be required. Identify any government-owned facilities, industrial plant equipment, or special tooling that are proposed for use on the project. Provide evidence that such facilities or equipment will be made available if the applicant is successful in obtaining funding. Before requesting a major item of capital equipment, the proposer should determine if sharing or loan of equipment already within the organization is a feasible alternative to purchase. Where such arrangements cannot be made, the proposal should so state. The need for items that typically can be used for both research and non-research purposes should be explained.

SUPPORTING BUDGETARY INFORMATION

This section should include the supporting information required by Forms C and D. In this NRA, the terms "cost" and "budget" are used synonymously. Sufficient proposal cost detail and supporting information will facilitate a speedy evaluation and award. Dollar amounts proposed with no explanation (e.g., Equipment: \$1,000, or Labor: \$6,000) may cause delays in evaluation and award.

Generally, NASA will evaluate costs as to reasonableness, allowability, and allocatability. The budgetary forms define the desired detail, but each category should be explained in the body of the proposal. Offerors should exercise prudent judgment in determining what to include in the proposal, as the amount of detail necessarily varies with the complexity of the proposal.

The following examples indicate the suggested manner to prepare a cost breakdown.

Direct Labor

Labor costs should be segregated by titles or disciplines with estimated hours and rates for each. Estimates should include a basis of estimate such as currently paid rates or outstanding offers to prospective employees. This format allows the Government to assess cost reasonableness by various means including comparison to similar skills at other organizations.

Example:

| | <u>Hours</u> | <u>Rate</u> | <u>Amount</u> |
|------------------------|--------------|----------------|---------------|
| Principal Investigator | 100 | \$19.34 | \$1,934 |
| Co-Investigator | 450 | \$11.78 | \$5,301 |
| Clerical Support | <u>75</u> | <u>\$ 8.70</u> | <u>\$ 652</u> |
| Total | 625 | | \$7,887 |

Indirect Costs

Indirect costs should be explained to an extent that will allow the Government to understand the basis for the estimate. Examples of prior year historical rates, current variances from those rates, or an explanation of other basis of estimates should be included. Where costs are based on allocation percentages or dollar rates, an explanation of rate and application base relationships should be given. For example, the base to which the General and Administrative (G&A) rate is applied could be explained as: application base equals total costs before G&A less subcontracts.

Other Costs

Each significant cost category should be detailed, explained, and substantiated such as travel. Past experience has indicated that up to six trips may be necessary for a flight experiment. (i.e., Crew Familiarization

(Johnson Space Center, JSC), pre-flight Science Verification Test (Kennedy Space Center, KSC), L-14 day Press Briefing (JSC), Mission Preparation/Operations (KSC), Post-Flight Ground Control (KSC), Post-Flight Results Symposium). Format should be as follows:

Travel Costs

| <u>Destination</u> | <u>Duration</u> | <u>Airfare</u> | <u>Per Diem</u> | <u>Total</u> |
|--------------------|-----------------|----------------|-----------------|--------------|
| Moffett Field, CA | 3 days | \$500 | \$300 | \$800 |
| Washington, DC. | 1 day | \$500 | \$100 | \$600 |
| Total | | | | \$1,400 |

If the proposal is for competitive renewal of an ongoing research effort beyond the present period of approval, the proposal cost section should include an estimate of any significant amount of unspent or uncommitted funds remaining at the completion of the current period of performance.

The supporting budgetary information section of the proposal should include information concerning other current projects being conducted by the Principal Investigator and funded either by NASA or any other Government agency.

Provide the title of project, the sponsoring agency, the project period, the investigator's time commitment, and the value of the project. The following format is recommended:

| Funding Organization | Title | Number | Total Project | | Direct Costs |
|---------------------------------|---------------------|-----------------|----------------------|-------------------------|-------------------------|
| | | | Period | Total Effort | |
| NIH | Bone Mineralization | R01 NS 01234-06 | 12/89-11/94 | 30% | \$100,000 |
| NSF | Osteosclerosis | DRF 7683-05 | 6/90-5/93 | 10% | \$20,000 |

SPECIAL MATTERS

The "Special Matters" section must contain a statement from the proposer's institution which states that the proposed work will meet all Federal and local human subject requirements and animal care and use requirements, if applicable. Note that no animal subjects may be utilized unless specific information justifying and describing their use is included in the proposal. Policies regarding the protection of human research subjects in NASA sponsored research are detailed in NASA Management Instruction (NMI) 7100.8B (Protection of Human

Research Subjects), and animal care and use requirements are detailed in the NASA Code of Federal Regulations (CFR) 1232 (Care and Use of Animals in the Conduct of NASA Activities), both of which are available from the Life Sciences Division, Code UL, NASA Headquarters, Washington, DC 20546. Assurance of compliance with human subject and/or animal care provisions is required on Form A, to be submitted with each proposal. In addition, a letter signed by the chairperson of the Institutional Review Board (IRB) or institutional Animal Care and Use Committee (ACUC) or both, as appropriate, regarding approval of the experimental protocol, should be included with each copy of the proposal. All non-NASA proposals providing ACUC approval must also contain the institution's Public Health Assurance number. Applicants should note that this is a strong requirement: **Review of the proposal will not be undertaken until this information is supplied to NASA.**

NASA is a participating agency for the “Presidential Early Career Awards for Scientists and Engineers.” NASA will select its Awardees based on exceptionally meritorious proposals funded through the traditional grants process, including this NRA. Awardees must be U.S. citizens, nationals, or permanent residents who have received their highest degree within five years. Applicants should indicate in the Special Matters section that they are eligible and wish to be considered for the award. For additional information about the “NASA Presidential Early Career Awards for Scientists and Engineers” contact the Chief Scientist, NASA Headquarters, 300 E Street, S.W., Washington, D.C. 20546.

CERTIFICATION REGARDING DRUG-FREE WORKPLACE (FORM F);
CERTIFICATION REGARDING DEBARMENT, SUSPENSION, AND OTHER
RESPONSIBILITY MATTERS (FORM G); and CERTIFICATION
REGARDING LOBBYING (FORM H)

These three certifications are required of all U.S. applicants before a grant/contract can be awarded. They are not required of foreign proposals with no budget section.

COMPUTER DISKETTE (3.5 INCH, MACINTOSH OR PC FORMAT)
CONTAINING AN ELECTRONIC COPY OF THE PRINCIPAL
INVESTIGATOR'S NAME, ADDRESS, TELEPHONE AND FAX
NUMBERS, E-MAIL ADDRESS, AND THE COMPLETE PROJECT
TITLE AND ABSTRACT AS PROVIDED ON FORM B

Self-explanatory.

CHECKLIST FOR PROPOSERS (FORM I)

One copy of a completed version of this checklist should be attached to the transmittal letter.

APPENDICES, IF ANY

Renewal applications (for competing renewal of currently funded activity) must include an Appendix providing a Progress Report of the previously funded activity. That report should give the beginning and ending dates for the period covered since the project was last reviewed competitively and provide a list of all personnel who have worked on the project during this period (including dates of service and percentages of their appointments devoted to the project). The report should also summarize the previous project's original goals and specific objectives and provide a succinct account of published and unpublished results indicating progress toward their achievement. Changes in these objectives during the course of the project and a rationale for these changes should be presented. The importance of the findings should be summarized and discussed. Finally, a list should be provided of the titles and complete references to all publications, manuscripts submitted or accepted for publication, patents, invention reports, and other printed materials that have resulted from the project since it was last competitively reviewed.

Other Appendices may be appropriate for particular proposals.

FORM A

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
OFFICE OF LIFE & MICROGRAVITY SCIENCES & APPLICATIONS
LIFE SCIENCES DIVISION

SOLICITED PROPOSAL APPLICATION
PLEASE FOLLOW INSTRUCTIONS CAREFULLY

LEAVE BLANK

NUMBER

REVIEW GROUP

DATE RECEIVED

1. COMPLETE TITLE OF PROJECT

2. PRINCIPAL INVESTIGATOR/PROGRAM DIRECTOR *(First, middle, and last name; degrees; position title)*

3. COMPLETE MAILING ADDRESS

Internal Mail Code or Location
Office or Organization Division
Agency/Center, Company, or Institution
Street or P.O. Box
City, State, Zip Code

4. TELEPHONE NUMBER
(area code, number, extension)

FAX NUMBER

E-MAIL ADDRESS

5. CONGRESSIONAL DISTRICT

6. SOCIAL SECURITY #

7. IS THIS PROPOSAL ☐ NEW ☐ RENEWAL ☐ REVISED

8. HAS THIS PROPOSAL (OR SIMILAR REQUEST) BEEN SUBMITTED TO NASA OR ANY OTHER AGENCY?

☐ No ☐ Yes IF YES, SPECIFY AGENCY AND YEAR SUBMITTED:

9. HUMAN SUBJECTS

9a. ☐ No ☐ Yes

9b. EXEMPTION # OR IRB APPROVAL DATE _____

9c. Assurance of Compliance # _____

10. VERTEBRATE ANIMALS

10a. ☐ No ☐ Yes

10b. ACUC Approval Date _____

10c. PHS Animal Welfare Assurance # _____

11. DATES OF ENTIRE PROPOSED
PROJECT PERIODFrom:
Through:12. COSTS REQUESTED FOR FIRST
12-MONTH BUDGET PERIOD12a. Direct Costs
\$12b. Total Costs
\$13. COSTS REQUESTED FOR ENTIRE
PROPOSED PROJECT PERIOD13a. Direct Costs
\$13b. Total Costs
\$14. APPLICANT ORGANIZATION *(Organization Name)*

15. TYPE OF ORGANIZATION

☐ Non Profit ☐ For Profit *(General)* ☐ For Profit *(Small Business)* ☐ Public, Specify: ☐ Federal ☐ State ☐ Local16. ORGANIZATION OFFICIAL TO BE NOTIFIED IF AN AWARD
IS MADE *(Name, title, address and telephone number)*17. OFFICIAL SIGNING FOR APPLICANT ORGANIZATION
*(Name, title, and telephone number)*18. PRINCIPAL INVESTIGATOR/PROGRAM DIRECTOR ASSURANCE:
I agree to accept responsibility for the scientific conduct of the project and to provide the required progress reports if a grant is awarded as a result of this application. Willful provision of false information is a criminal offense (U.S. Code, Title 18, Section 1001).SIGNATURE OF PERSON NAMED IN 2
(In ink "Per" signature not acceptable.)

DATE

19. CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true and complete to the best of my knowledge, and accept the obligation to comply with NASA terms and conditions if a grant is awarded as the result of this application. A willfully false certification is a criminal offense (U.S. Code, Title 18, Section 1001).

SIGNATURE OF PERSON NAMED IN 17
(In ink "Per" signature not acceptable.)

DATE

FORM B**PROPOSAL SUMMARY****Principal Investigator:** _____**Co- Investigators:** _____

_____**Proposal Title:** _____
_____**Proposal Type:**
SCIENTIFIC PROPOSAL _____ **OR** **TECHNICAL PROPOSAL** __________ **GROUND- BASED RESEARCH****OR**_____ **SPACE- FLIGHT EXPERIMENT**_____ **SMALL PAYLOADS**_____ **SPACE STATION EARLY UTILIZATION****Program Applicability**

{Place a single check in the "Primary Area" column next to the program that is most closely aligned with your proposal. Optional: Place a check in the "Secondary Area" column **if** your proposal has a dual-program emphasis }

| | <u>Primary Area</u> | <u>Secondary Area</u> |
|--------------------------------------|---------------------|-----------------------|
| SPACE BIOLOGY | _____ | _____ |
| SPACE PHYSIOLOGY AND COUNTERMEASURES | _____ | _____ |
| ENVIRONMENTAL HEALTH | _____ | _____ |
| SPACE RADIATION HEALTH | _____ | _____ |
| BEHAVIOR AND PERFORMANCE | _____ | _____ |
| ADVANCED TECHNOLOGY DEVELOPMENT | _____ | _____ |
| DATA ANALYSIS | _____ | _____ |

Abstract:

{Prepare a brief description of the application stating the broad, long-term objectives and specific aims of the proposed work, making reference to the relevance of this work to NASA's mission as described in the NRA. Describe concisely the research design and methods for achieving these objectives and aims. This abstract is meant to serve as a succinct and accurate description of the proposed work when separated from this application. Use separate page; limit to 300 words. }

Key Words:

{ Assign numbers (1- highest relevance, 3-moderate relevance) to the areas that best describe your proposed research. Choose a maximum of three areas }

| | | |
|--------------------------------|---------------------------------------|------------------------------|
| ___ Neuroscience | ___ Spacecraft Systems and Hardware | ___ Developmental Physiology |
| ___ Sensorimotor Integration | ___ Space Suit Design | ___ Genetics |
| ___ Behavior | ___ EVA/IVA Physiology | ___ Cellular Genetics |
| ___ Human Factors Studies | ___ Radiation | ___ Plant Genetics |
| ___ Skeletal System | ___ Advanced Life Support | ___ Plant Development |
| ___ Muscle Physiology | ___ Fluid and Electrolyte Homeostasis | ___ Plant Growth |
| ___ Immunology | ___ Regulatory Physiology | ___ Plant Propagation |
| ___ Cardiopulmonary Physiology | ___ Cell Biology | ___ Molecular Biology |
| ___ Physico-Chemical | ___ Intra- and Inter-Cellular | ___ Reproductive Physiology |
| Air/Food/Water Regeneration | Communication | ___ Other |

FORM C

PRINCIPAL INVESTIGATOR/PROGRAM DIRECTOR: _____

| | | | | | |
|--|------------------------|-------------------------------------|--------|-----------------|--------|
| DETAILED BUDGET FOR 12-MONTH BUDGET PERIOD DIRECT COSTS ONLY | | FROM | | THROUGH | |
| Duplicate this form for each year of grant support requested | | DOLLAR AMOUNT REQUESTS (Omit cents) | | | |
| PERSONNEL (Applicant Organization Only) | | EFFORT ON PROJECT | SALARY | FRINGE BENEFITS | TOTALS |
| NAME | ROLE IN PROJECT | | | | |
| | Principal Investigator | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| SUBTOTALS → | | | | | |
| CONSULTANT COSTS | | | | | |
| EQUIPMENT (Itemize, use additional sheet if needed) | | | | | |
| SUPPLIES (Itemize by category, use additional sheet if needed) | | | | | |
| TRAVEL | DOMESTIC | | | | |
| | FOREIGN | | | | |
| OTHER EXPENSES (Itemize by category, use additional sheet if needed) | | | | | |
| TOTAL DIRECT COSTS FOR FIRST 12-MONTH BUDGET PERIOD (Item 12a, Form A) | | | | \$ | |
| INDIRECT COSTS FOR FIRST 12-MONTH BUDGET PERIOD | | | | \$ | |
| TOTAL COSTS FOR FIRST 12-MONTH BUDGET PERIOD (Item 12b, Form A) | | | | \$ | |

FORM D

PRINCIPAL INVESTIGATOR/PROGRAM DIRECTOR: _____

BUDGET FOR ENTIRE PROJECT PERIOD DIRECT COSTS ONLY

| BUDGET CATEGORY TOTALS | | 1st BUDGET PERIOD | ADDITIONAL YEARS OF SUPPORT REQUESTED | | |
|---|----------|-------------------|---------------------------------------|-----|-----|
| | | | 2nd | 3rd | 4th |
| PERSONNEL (Salary and Fringe Benefits) (Applicant organization only) | | | | | |
| CONSULTANT COSTS | | | | | |
| EQUIPMENT | | | | | |
| SUPPLIES | | | | | |
| TRAVEL | DOMESTIC | | | | |
| | FOREIGN | | | | |
| OTHER EXPENSES | | | | | |
| TOTAL DIRECT COSTS FOR EACH BUDGET PERIOD | | \$ | \$ | \$ | \$ |
| TOTAL INDIRECT COSTS FOR EACH BUDGET PERIOD | | \$ | \$ | \$ | \$ |
| TOTAL DIRECT + INDIRECT COSTS FOR EACH PERIOD | | \$ | \$ | \$ | \$ |
| TOTAL DIRECT + INDIRECT COSTS FOR ENTIRE PROJECT | | | | | \$ |

JUSTIFICATION FOR UNUSUAL EXPENSES (Detail Justification in Cost Section of Proposal)

FORM E

SPACE-FLIGHT EXPERIMENT SUPPLEMENTARY APPLICATION FORM

The following form should be completed by all investigators proposing flight experiments. This form should be inserted into the Project Description section of the proposal. (Provide responses on additional sheets, as necessary.)

Principal Investigator _____

Proposal Title _____

Type of Flight Experiment: ☐ **Small Payloads** ☐ **Space Station Early Utilization**

- (1) List major hardware items required in this investigation. Hardware available is listed in Appendix D.
- (2) List any additional hardware required in this investigation. This includes any Experiment Unique Equipment (EUE) that needs to be developed.
- (3) Estimate number of middeck lockers needed to accommodate proposed experiment volume if not using hardware listed in Appendix D.
- (4) Estimate access time
 - a) Is late access needed and when?(i.e., do you need to load the experiment and/or species within a certain time period before a launch?)
 - b) Is early removal needed and when? (i.e., do you need to remove the experiment and/or species within a certain time period after landing? If so, please specify requirement.)
- (5) Identify potentially hazardous materials, including biowaste.
- (6) Are there any specific conditions requested (e.g., air composition, humidity, thermal, illumination, inflight observations)?
- (7) For Space Station experiments, estimate the maximum and minimum number of days of microgravity exposure required.
- (8) Estimate the total set of operations required to carry out the experiment in space (e.g., the number of sessions of crew activity and the time required for each session).
- (9) Estimate amount of time for crew participation with experiment before, during and after flight (e.g., data collection, crew training, etc.)

Responses (continue on additional sheets):

FORM F

CERTIFICATION REGARDING DRUG-FREE WORKPLACE REQUIREMENTS

This certification is required by the regulations implementing the Drug-Free Workplace Act of 1988, 34 CFR Part 85, Subpart F. The regulations, published in the January 31, 1989 Federal Register, require certification by grantees, prior to award, that they will maintain a drug-free workplace. The certification set out below is a material representation of fact upon which reliance will be placed when the agency determines to award the grant. False certification or violation of the certification shall be grounds for suspension of payments, suspension or termination of grants, or government-wide suspension or debarment (see 34 CFR Part 85, Sections 85.615 and 85.620).

I. GRANTEES OTHER THAN INDIVIDUALS

A. The grantee certifies that it will provide a drug-free workplace by:

- (a) Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession or use of a controlled substance is prohibited in the grantee's workplace and specifying the actions that will be taken against employees for violation of such prohibition;
- (b) Establishing a drug-free awareness program to inform employees about
 - (1) The dangers of drug abuse in the workplace;
 - (2) The grantees policy of maintaining a drug-free workplace;
 - (3) Any available drug counseling, rehabilitation, and employee assistance programs; and
 - (4) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace;
- (c) Making it a requirement that each employee to be engaged in the performance of the grant be given a copy of the statement required by paragraph (a);
- (d) Notifying the employee in the statement required by paragraph (a) that, as a condition of employment under the grant, the employee will
 - (1) Abide by the terms of the statement; and
 - (2) Notify the employer of any criminal drug statute conviction for a violation occurring in the workplace no later than five days after such conviction;
- (e) Notifying the agency within ten days after receiving notice under subparagraph (d) (2) from an employee or otherwise receiving actual notice of such conviction;
- (f) Taking one of the following actions, within 30 days of receiving notice under subparagraph (d) (2), with respect to any employee who is so convicted
 - (1) Taking appropriate personnel action against such an employee, up to and including termination; or
 - (2) Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or Local health, Law enforcement, or other appropriate agency;
- (g) Making a good faith effort to continue to maintain a drug-free workplace through implementation of paragraphs (a), (b), (c), (d), (e), and (f).

B. The grantee shall insert in the space provided below the site(s) for the performance or work done in connection with the specific grant:

Place of Performance (Street address, city, county, state, zip code)

Check ____ if there are workplaces on file that are not identified here.

II. GRANTEES WHO ARE INDIVIDUALS

The grantee certifies that, as a condition of the grant, he or she will not engage in the unlawful manufacture, distribution, dispensing, possession or use of a controlled substance in conducting any activity with the grant.

Organization Name

AO or NRA Number and Title

Printed Name and Title of Authorized Representative

Signature

Date

Printed Principal Investigator Name

Proposal Title

**CERTIFICATION REGARDING
DEBARMENT, SUSPENSION, AND OTHER RESPONSIBILITY MATTERS
PRIMARY COVERED TRANSACTIONS**

This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 34 CFR Part 85, Section 85.510, Participants' responsibilities. The regulations were published as Part VII of the May 28, 1988 Federal Register (pages 19160-19211). Copies of the regulations may be obtained by contacting the U.S. Department of Education, Grants and Contracts Service, 400 Maryland Avenue, S.W. (Room 3633 GSA Regional Office Building No. 3), Washington, D.C. 20202-4725, telephone (202) 732-2505.

A. The applicant certifies that it and its principals:

- (a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
- (b) Have not within a three-year period preceding this application been convicted or had a civil judgement rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or Local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
- (c) Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State, or Local) with commission of any of the offenses enumerated in paragraph A.(b) of this certification; and
- (d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or Local) terminated for cause or default; and

B. Where the applicant is unable to certify to any of the statements in this certification, he or she shall attach an explanation to this application.

C. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lowered Tier Covered Transactions (Subgrants or Subcontracts)

- (a) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principles is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any federal department of agency.
- (b) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Organization Name

AO or NRA Number and Title

Printed Name and Title of Authorized Representative

Signature

Date

Printed Principal Investigator Name

Proposal Title

FORM H

CERTIFICATION REGARDING LOBBYING

As required by S 1352 Title 31 of the U.S. Code for persons entering into a grant or cooperative agreement over \$100,000, the applicant certifies that:

(a) No Federal appropriated funds have been paid or will be paid by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, in connection with making of any Federal grant, the entering into of any cooperative, and the extension, continuation, renewal, amendment, or modification of any Federal grant or cooperative agreement;

(b) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting an officer or employee of any agency, Member of Congress, an or an employee of a Member of Congress in connection with this Federal grant or cooperative agreement, the undersigned shall complete Standard Form - LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(c) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subgrants, contracts under grants and cooperative agreements, and subcontracts), and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by S1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

Organization Name

AO or NRA Number and name

Printed Name and Title of Authorized Representative

Signature

Date

Printed Principal Investigator Name

Proposal Title

FORM I

CHECKLIST FOR PROPOSERS

The following Checklist should be enclosed with the transmittal letter and annotated to indicate that the stated items have been included in the proposal package.

Principal Investigator/Program Director _____

| | |
|---|--|
| <input type="checkbox"/> Form A: Solicited Proposal Application* | <input type="checkbox"/> Facilities and Equipment |
| <input type="checkbox"/> Form B: Proposal Summary | <input type="checkbox"/> Supporting Budgetary Information (include current support: list of other funded projects) |
| <input type="checkbox"/> Form C: Detailed 12 month Budget (First year of support) | <input type="checkbox"/> IRB or ACUC letter/ form regarding protocol approval, if applicable* |
| <input type="checkbox"/> Form D: Summary Budget Form | <input type="checkbox"/> Form F: Certification Regarding Drug-Free Workplace* |
| <input type="checkbox"/> Title Page | <input type="checkbox"/> Form G: Certification Regarding Debarment, Suspension, and Other Responsibility Matters* |
| <input type="checkbox"/> Project Description | <input type="checkbox"/> Form H: Certification Regarding Lobbying* |
| <input type="checkbox"/> Form E: Space-Flight Exp. Supplementary Information, if applicable | <input type="checkbox"/> Appendices, if any |
| <input type="checkbox"/> Management Approach | <input type="checkbox"/> 20 copies of all material listed above |
| <input type="checkbox"/> Personnel, CVs; Biographical Summaries | <input type="checkbox"/> 3.5 inch computer diskette containing PI's name, address, complete project title and abstract |

*One signed original form required

Only one copy of the following materials needs to be submitted:

| |
|--|
| <input type="checkbox"/> Transmittal Letter |
| <input type="checkbox"/> Form I: This checklist indicates all items have been enclosed |

NASA Research Announcement (NRA) Mailing List Update

This is the form to update information for the NASA Office of Life & Microgravity Sciences & Applications (OLMSA) NRA mailing list. Please fill out **CONTACT INFORMATION** completely. Check only those that apply in **INSTITUTION TYPE** and **PROGRAM AREAS/DISCIPLINES**. Fold the form, secure with tape (do not staple), and mail it back to the address on the reverse side. Proper postage must be applied.

Mailing list updates may also be submitted electronically via E-Mail or World Wide Web to the following addresses:

E-Mail: loi@hq.nasa.gov

World Wide Web: <http://peer1.idi.usra.edu/>

Check one:

- | | |
|---|---|
| <input type="checkbox"/> 1. Please add my name to the mailing list. | <input type="checkbox"/> 3. Please change my current listing (please attach mailing label). |
| <input type="checkbox"/> 2. Please remove my name from the mailing list (please attach mailing label). | <input type="checkbox"/> 4. Please leave my current listing unchanged (please attach mailing label). |

Contact Information

If your address has changed or your mailing label is incorrect, please provide COMPLETE contact information.

| | | | |
|--|----------------------|---------------------------------------|----------------------|
| Prefix: (Mr., Mrs., Ms., Dr., Prof., etc.) | <input type="text"/> | Suffix: (M.D., Ph.D., Jr., III, etc.) | <input type="text"/> |
| Name, First: | <input type="text"/> | Last: | <input type="text"/> |
| Position Title: | <input type="text"/> | | |
| Mail Code, Loc: | <input type="text"/> | | |
| Office, Dept, Div: | <input type="text"/> | | |
| Org (Agency/Ctr, Univ): | <input type="text"/> | | |
| Street or PO Box: | <input type="text"/> | | |
| City: | <input type="text"/> | State: | <input type="text"/> |
| Zip Code: | <input type="text"/> | Country: | <input type="text"/> |
| Telephone No: | <input type="text"/> | Fax No: | <input type="text"/> |
| Internet/E-Mail: | <input type="text"/> | | |

Institution Type

(check all that apply)

- | | | |
|--|---|---|
| <input type="checkbox"/> 1. College or University | <input type="checkbox"/> 4. NASA Center | <input type="checkbox"/> 7. Small Business |
| <input type="checkbox"/> 2. Minority College or University | <input type="checkbox"/> 5. Other Government Agency | <input type="checkbox"/> 8. Private Industry |
| <input type="checkbox"/> 3. Minority Business | <input type="checkbox"/> 6. Nonprofit Corporation | <input type="checkbox"/> 9. Foreign Addressee |

Program Areas/Disciplines

(check main area of interest)

- | | |
|--|---|
| <input type="checkbox"/> 1. Life Sciences | <input type="checkbox"/> 2. Microgravity Sciences |
| <input type="checkbox"/> A. Advanced Life Support | <input type="checkbox"/> A. Biotechnology |
| <input type="checkbox"/> B. Advanced Technology Development | <input type="checkbox"/> B. Combustion Science |
| <input type="checkbox"/> C. Data Analysis | <input type="checkbox"/> C. Fluid Physics |
| <input type="checkbox"/> D. Environmental Health | <input type="checkbox"/> D. Materials Science |
| <input type="checkbox"/> E. Space Biology | <input type="checkbox"/> E. Microgravity Physics |
| <input type="checkbox"/> F. Space Human Factors | |
| <input type="checkbox"/> G. Space Physiology & Countermeasures | |
| <input type="checkbox"/> H. Space Radiation Health | |
- ☐ Please send me notifications of announcements via E-Mail only.

PLEASE TAPE (DO NOT STAPLE)

PLACE STAMP
HERE
POST OFFICE
WILL NOT
DELIVER
WITHOUT PROPER
POSTAGE

INFORMATION DYNAMICS, INC.
300 D STREET, SW
SUITE 801
WASHINGTON, DC 20024

**NASA
OFFICIAL MAILING LIST
UPDATE**